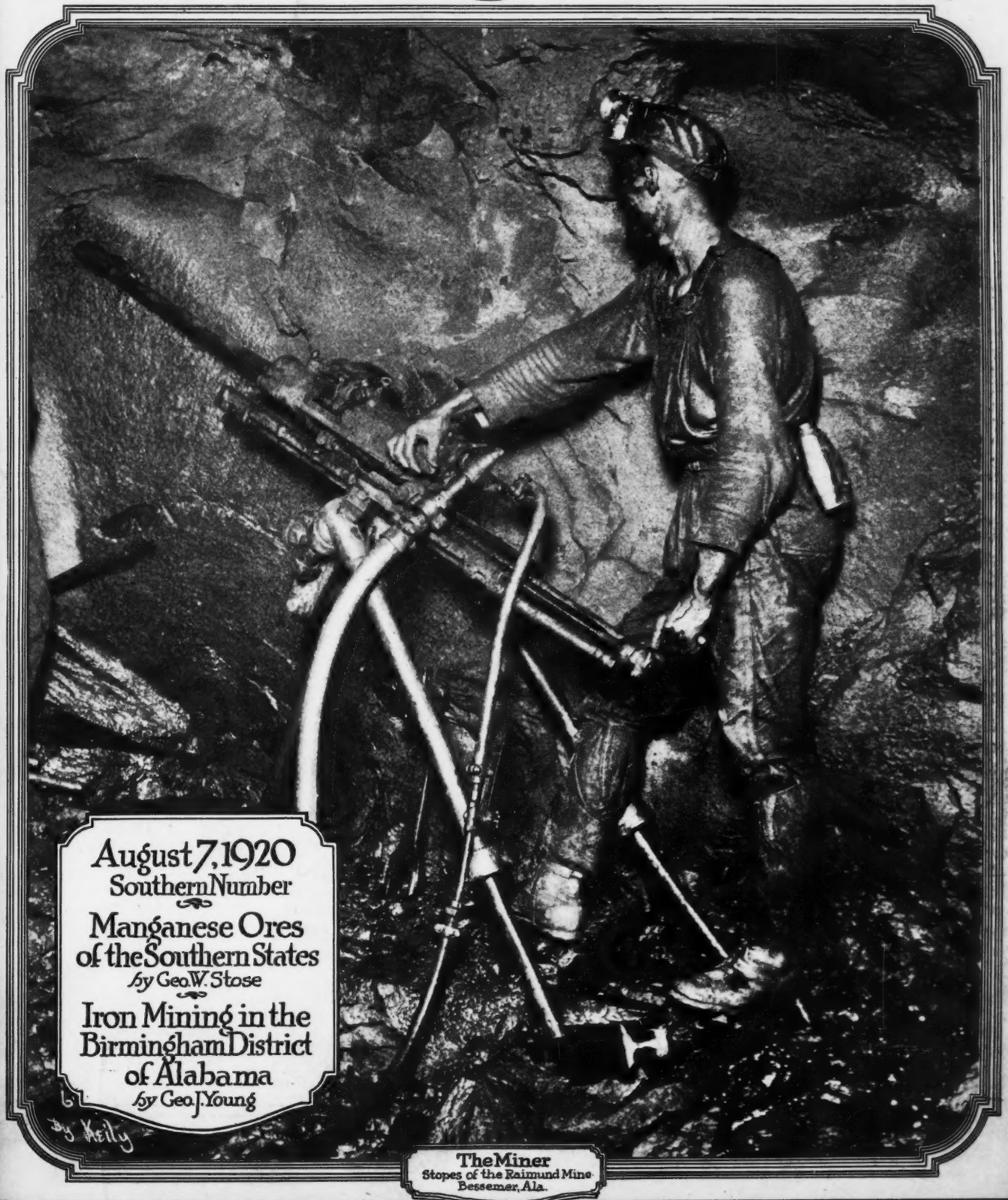
157

A Weekly Journal of the Mining & Mineral Industries — Largest Circulation of Any Mining & Metal Journal in the World

Price 25 Cents

GENERAL LIBRARY -9 1920 MICH.

ENGINEERING AND MINING JOURNAL



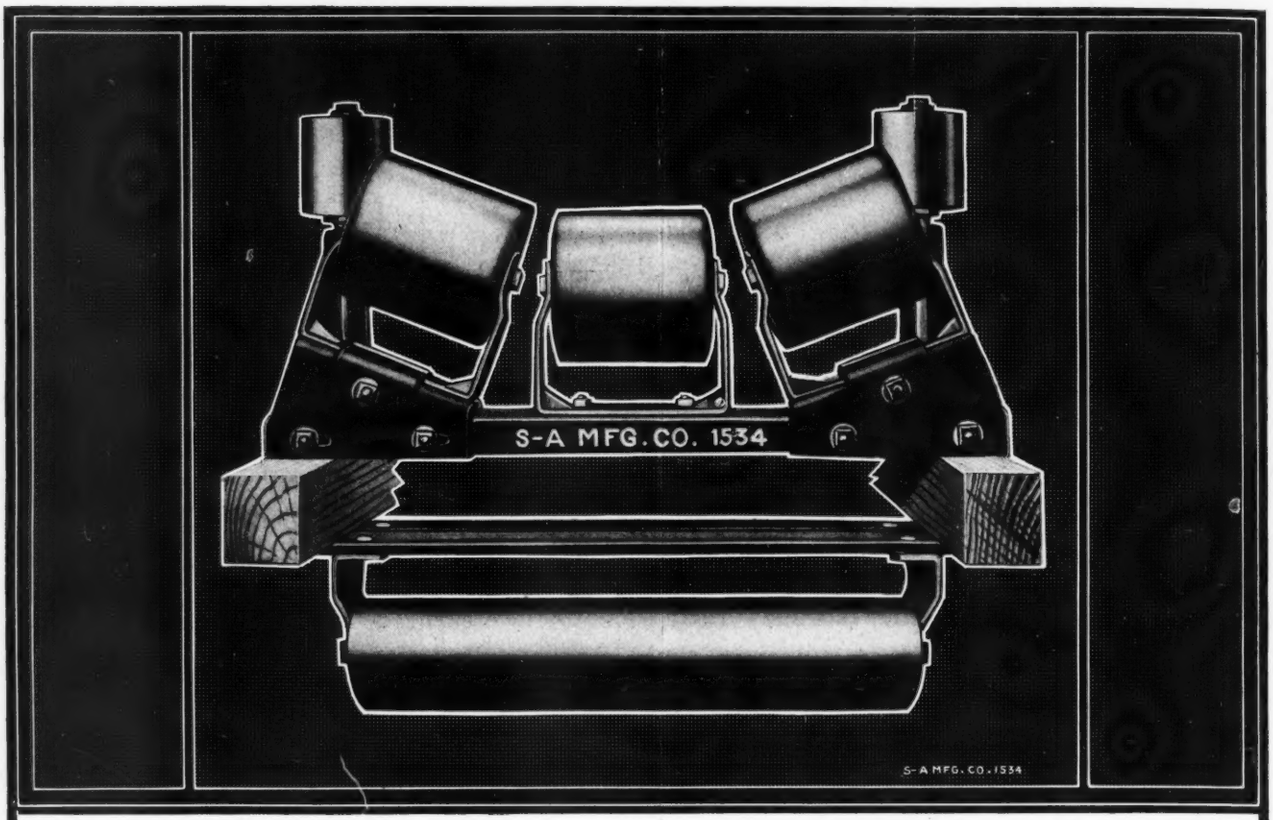
August 7, 1920
Southern Number

Manganese Ores of the Southern States
by Geo. W. Stose

Iron Mining in the Birmingham District of Alabama
by Geo. J. Young

The Miner
Stopes of the Raimund Mine
Bessemer, Ala.

The Market Situation of Phosphate Rock



S-A UNIT CARRIERS

Conveyor operating expense is an important consideration. Our engineers invite your inquiries with reference to the actual savings which can be made by equipping with Unit Carriers.

Take the power item alone and figure the saving made possible by carriers which require thirty per cent less power than other types.

Replacing the old conveyor belt is always a costly proposition, yet the life of belts is materially prolonged when operated over S-A Unit Ball Bearing Carriers.

Write for Prices

Stephens-Adamson Mfg. Co., Aurora, Ill.

J. E. SPURR
Editor
G. J. YOUNG
Western Editor
D. E. A. CHARLTON
Managing Editor
A. H. HUBBELL
News Editor
E. H. ROBIE
Metallurgical Editor

Engineering and Mining Journal

A Weekly Journal of the Mining and Mineral Industries

METALS NON-METALS PETROLEUM

F. E. WORMSER
W. N. P. REED
CLEVELAND ABBE, Jr.
Assistant Editors.
BENJAMIN L. MILLER
J. VOLNEY LEWIS
Special
Consulting Editors

Volume 110 **New York, August 7, 1920** *Number* 6

The Mining Industry In the South

HOW important do you think the mining industry is in the South as compared with other industries? Off-hand, probably you would say that it was subordinate to agriculture and timber. Yet the figures of the tonnage hauled by the Southern Railway in 1918 show that

THE INDUSTRIES OF THE SOUTH

the products of the mines formed 40.49 per cent of the total. Next come manufactures and miscellaneous, with 32.69 per cent; then forest products, with 16.12 per cent; agricultural products make up only 9.56 per cent, and animal products, 1.14 per cent. Who would have thought it? King Cotton made up only 1.56 per cent of the grand total.

The Major Southern Mining Industries

ORDINARILY the South is not thought of as a mining section, the agricultural, timber and manufacturing industries of that region of the United States being so great as to obscure the industry of the mining of raw ores from the rock. Nevertheless, it is by no means poor in this respect. There are certain mining industries in the South that are of the first order of importance, and which are growing and prosperous.

Most people are familiar with the important Southern iron and coal industry, especially that which centers around Birmingham, Ala. The iron ores of the South constitute a vast reserve, according to Eckel, which will become increasingly important as the richer ores of the Lake Superior district are mined. Iron mining at Birmingham is treated in a special article in this issue.

The sulphur-mining industry is one of the most important among the mining industries of the Southern states. The development of sulphur mining has been phenomenal, and now this Gulf district is by far the most important and most productive in the world, eclipsing Sicily, which earlier held the predominance. The sulphur is one of the products of those remarkable humps or domes which rise like blisters from the Tertiary strata which fringe the coast of the Gulf of Mexico. From these domes not only sulphur but much petroleum has been obtained (although not from the same dome), and they contain as well vast quantities of gypsum. The extraction of the sulphur from them was made possible by the invention of the "Frasch process," by which superheated steam is pumped down through a pipe into the sulphur deposit (which is inaccessible for ordinary operations, on account of mining conditions), and the steam liquefies the sulphur so that it can be drawn off in liquid form. This process, and the consequent production, have given the United States not only a vast supply of sulphur, but, at will, the control of the world's sulphur market.

It is especially propitious that in an agricultural region another of the principal fertilizer minerals—phosphate rock—is found in vast quantity. The phosphate rock deposits of the South (especially those of Tennessee, South Carolina, and Florida) are very extensive, and with the vast deposits of our Northwestern states (such as Idaho, Utah, and the neighboring region) give the United States by far the largest reserves of rock phosphate possessed by any nation in the world. With sulphuric acid, the acid phosphate used as fertilizer is made, and recently it has been found that raw phosphate rock, ground fine, lends its needed phosphorus to assimilation by the soil, although more slowly; but the cheapness recommends the plan. The practically inexhaustible phosphate deposits of the Northwestern states are retarded in development by the relative remoteness from the main fertilizer markets, but those of the South are well situated

Another mining industry, of less importance, but far from being unimportant—the barytes industry—is centered in the South. The chief barytes state is now Georgia, which recently wrested the leadership from the other important producer, Missouri. The deposits of Georgia are extensive, and the demand for use in various industries is steady and increasing. Like some others of the non-metallic minerals, the barytes-mining industry seems destined to increase, and when mines are located not too far from the manufacturing districts where the products are used (and this is the case with the barytes industry of the South), the future is excellent. Geographic location plays a much larger part with deposits of non-metallic minerals than with most deposits of metallic minerals.

The clay-mining industry is of great importance to a country. Clays are essential to many industries, and the manufactured products are varied. Especially are the higher-grade varieties of great importance. They

are used in pottery, tiles, glazing, electrical apparatus, as fillers for paper, and a multitude of every-day uses. High-grade clays formerly came mainly from England, and to a large extent still do. But American clay is being developed and graded so that it is being more and more extensively employed; and the industry centers in the South and the South-Middle states. The Northern part of the United States, particularly the glaciated area, is unfavorable to the geologic development of these valuable clays; but the geologic history and climate of the South have been favorable to their accumulation, as the result of saprolitic disintegration of pegmatitic and other favorable rocks.

The dominant aluminum industry of America, which is the largest in the world, owes its existence to the bauxite ores of the Southern states, which are extensive, as in Georgia, Arkansas, and Tennessee; and, as mined chiefly by the Aluminum Company of America and its subsidiaries, constitute an important industry. Though aluminum is one of the commonest elements of the earth's crust, it is recoverable easily only from its oxide, bauxite: the usual silicate is refractory.

Altogether, we are justified in regarding the South, from many angles, as a mining region of much past, present, and future importance, and one rich in those large deposits of minerals whose exploitation will probably outlive that of many more spectacular metal-mining districts in other parts of the world.

The Varied Lesser Southern Mining Industries

IN THE preceding editorial we have alluded briefly to those mining industries in which the Southern states excel the rest of the United States, and in the case of sulphur, at least, the rest of the world; and which, as a consequence, are of major present importance. Besides these outstanding examples, however, the mineral industries of the South are varied.

The gold-mining industry of North America had its first real beginning in the Appalachian gold belt, which runs from Virginia through North and South Carolina and Georgia into Alabama. In this region are gold-quartz veins in schist, associated with siliceous (granitic) intrusive rocks. Geologically, they are very similar to the gold-quartz veins of Canada, as seen, for example, in Ontario: and, like these, are often of uncertain persistence and spotty as to values. Nevertheless, the gold production of this region was in the first half of the nineteenth century very considerable; and a mint was in operation at Charlotte, N. C. The California rush of 1849 diverted the Eastern miners to richer fields, and they have never returned. Efforts to revive mining in this region have almost invariably proved disappointing: nevertheless, the region is not without hope. The "saprolitic ores," or the results of surface disintegration of the gold-bearing schist, frequently contain gold in considerable quantities from the point of view of the placer miner; but treatment has proved difficult on account of the clay in the ores, which coats the amalgam and obstructs amalgamation.

Copper is found in the same general geologic province as the gold in the southern Appalachians, just as copper occurs in California in the same general region as the gold-quartz veins, and for the same reason—namely, that there exists the same genetic connection between the two metals in each province. The copper deposits of Virginia, especially at Virgilina, have had considerable production, but are now deserted; and occasional attempts to reopen them have usually had the same discouraging results as the attempts to revive gold mining. Nevertheless, the success of the mines at Ducktown, Tenn., in the same geological province, is a well-known present-day exception. This ore is highly pyritic, and the sulphuric acid is now being extracted as a valuable byproduct.

There is a large quantity of similar pyritic ores in the South, consisting of pyrite or pyrrhotite, although usually the copper content is not a commercial factor or is wanting. Therefore, when the supply of cheap pyrite ores from Spain was interrupted by the shipping shortage during the war, many of these deposits, such as that at Chestatee, in Georgia, became hopeful sources of pyrite supply. The development of the pyrite deposits as sources of sulphuric acid was interrupted by the termination of the war, and by the rapid development of the more cheaply produced sulphur of Texas and Louisiana; but it was established that there exists in the southern Appalachian region an adequate reserve of this material.

There was a rapid development of the manganese of the southern Appalachians during the war, when shipment from Russia and India was cut off and the supply from Brazil was threatened with interruption by the lack of shipping and by the German submarine warfare. Ordinarily, the Appalachian deposits cannot compete with the more abundant and richer ores of these foreign fields, being smaller and often relatively inaccessible; but in the emergency it was found that they constituted a very important reserve, especially of the higher-grade manganese, in which this country is deficient. The subject of the Appalachian manganese ores is treated in a special article in this issue.

In the early part of the nineteenth century the chromite deposits of Maryland were the most productive in the world, till they were eclipsed by those of Turkey. During the Great War, the old mines were reopened and the fact was established that not all the ore had been extracted; but it was also established that these ores cannot now compete with cheaper ores from newer discoveries.

In the mountains of North Carolina and the adjoining territory are vast amounts of valuable abrasives—corundum, emery, and garnet. Only the relative inaccessibility militates against the extensive development of these deposits, and the consequent difficulty in competing with more accessible domestic deposits, with emery from Greece and corundum from India, and with the artificial abrasives being manufactured in increasing quantity, especially from bauxite, by electric treatment.

During the war it was found that the most available deposits of zircon, rutile, and monazite were in the South. Pablo Beach, Florida, contains these minerals in the sands, and although not in quantity to compete with the phenomenal deposits of Brazil and India, they form a reserve which may be of value to the nation. North Carolina formerly had a monazite industry, working the mineral by placer methods from the streams; but with the best of the deposits worked out, it became impossible to compete longer with the foreign deposits. Also, probably the most productive of the accessible American deposits of rutile exists in Virginia. Monazite, it will be remembered, is the source of thorium,

the luminous material in the Welsbach gas mantles, and recently, also, of mesothorium, a substitute for radium, both in its therapeutic and its luminescent qualities. Zircon was sought during the war, especially as an element for a special steel alloy; and also rutile as a source of titanium for a titanium steel alloy, as well as for chemical uses.

The Federated Engineering Societies

THE Federated Engineering Societies, which was organized in Washington some time ago, is a going concern. It is not a proposed movement—it has a constitution and bylaws, and several societies have already joined the federation.

The American Engineering Council has voted hearty endorsement of the plan of organization and authorized its executive committee to render any assistance possible. It also voted to invite to future meetings of Engineering Council, delegates of the societies represented at Washington when the Federated Societies were organized, and also editors of technical journals who were interested.

The next move will be for more engineering societies to join the Federated Societies. Local societies, we understand, should not stand back waiting for societies of larger geographic scope. It is entirely fitting and advisable that they should consider making application independently and promptly.

Airplanes for Alaskan Surveying

THE developments which will make the airplane an every-day practical factor in surveying, exploring, and preliminary exploiting of mineral lands are moving with perceptible speed. On July 15 four army airplanes left Long Island for Alaska and return, a trip of 9,000 miles. The trip has a double purpose—to establish an aerial route to Alaska, and to make a photographic survey of certain typically unknown portions of Alaska. Photographers will form part of the crews.

It has been reported that at least a preliminary photographic survey would be attempted of the Yukon Flats, an immense flat alluvial area at the great bend of the Yukon, where it desists from its course in the direction of the Arctic, turns an angle, and heads for the Bering Sea. The great area is of fertile river-built soil, and is wooded, and it is traversed by many river channels. Its survey, with the outlining of its waterways, would help to open it up for settlement and the raising of hardy crops, which grow with very great rapidity in the almost or quite incessant daylight of the Arctic summer. By the ordinary methods of ground surveying, a district like this will take a great length of time, much labor and expense, and much mathematics to check closed traverses. It is safe to say that in the ordinary course of events the work would be postponed for years. It is believed that an airplane can photograph it so as to make an accurate map in a few days, at a relatively small cost. The question of vertical angles does not enter here, it will be observed, as the region is quite flat; and the two dimensions as viewed from an airplane is all there is to it. The route follows:

Mitchel Field to Erie, 350 miles; Erie to Grand Rapids, 300 miles; Grand Rapids to Winona, Mich., 310 miles; Winona to Fargo, N. D., 320 miles; Fargo to Portal, N. D., 290 miles; Portal to Saskatoon, Sask., 280 miles; Saskatoon to Edmonton, Alta., 300 miles; Edmonton to Jaspar, Alta, 200 miles; Jaspar to Prince George, B. C., 200 miles; Prince George to Hazelton, B. C., 220 miles; Hazelton to Wrangell, Alaska, 210 miles; Wrangell to White Horse, 300 miles; White Horse to Dawson, 250 miles; Dawson to Fairbanks, 275 miles; Fairbanks to Ruby, 240 miles; Ruby to Nome, 300 miles.

Among the supplies carried are concentrated food, fishing tackle and firearms, and precautionary supplies in case of delay or accident. The machines are equipped with 400-horsepower Liberty motors.

Judging from developments, the reconnaissance plane survey by airplane photographs is destined within the next few years to become one of the most active departments of surveying.

We may expect that the detailed map of the United States, which the Geological Survey has on hand, and which under ordinary conditions will be completed in some future generation, may become complete as to the reconnaissance plane survey within a few years. There is no reason why such a map as this should not precede the topographic surveys and the more detailed surveys, which will also be rendered far simpler by the airplane, carrying the surveyor swiftly to this or that peak of observation, and bringing him supplies. It is to be expected—indeed it may with confidence be prophesied—that Arctic Canada will be very soon mapped similarly, and an intimate and accurate knowledge of the thousands of waterways—lakes and streams—of this great region will assist immensely in the forming of plans for its further exploration and development.

Altogether, surveyors have now an instrument that will shorten their work as the invention of the harvester shortened the work of farm hands and increased the crops. But there is no reason for the surveyor to go on strike against this labor-saving machine; for a new school of surveyors will result. Are our engineering schools keeping abreast of the times, and instituting courses and training men in aerial plane surveying?

The Major Metal Quotations

WE ARE publishing this week in "What Others Think" a valuable and suggestive letter from a representative of one of the large factors in the lead-mining industry, a man who is a recognized expert in metal prices. The mining public, as well as ourselves, will enjoy this technical discussion and possibly other experts may contribute to it, for in this department of human knowledge, as in all others, the experts do not always agree.

New Coinage

CERTAIN journals have recently printed statements to the effect that a new 2-cent copper coin was authorized by Congress, and that the U. S. Mint is now preparing to strike such a coin. This information is incorrect. The Senate bill providing for a "Roosevelt 2-cent piece" failed to receive action by the House before adjournment, and therefore did not become a law.

The Congress did authorize, and the President approved, limited issues of three memorial 50-cent silver coins. One is to commemorate the centennial of the admission of the State of Maine (1819), another will commemorate the centennial of the admission of Alabama (1820), and the third is in honor of the tercentennial of the landing of the Pilgrims on the shores of Massachusetts Bay.

WHAT OTHERS THINK

The Major Metal Quotations

I have read with interest the editorial entitled "The Major Metal Quotations" published in the July 10 issue of the *Engineering and Mining Journal.*

I sincerely trust that the *Journal* will continue to publish original metal quotations in spite of any criticisms that may be received from disappointed miners, custom smelters, producers, traders, or consumers[1]. The *Journal* renders a great service for which I believe it derives no direct benefit.

As my interest is solely in lead I would like to enumerate the reasons why I hope the *Engineering and Mining Journal* will continue to quote lead prices, and also some of the difficulties in ascertaining the average price.

First, I believe that producers and consumers derive a great benefit from selling and buying lead at a monthly average price. The proof of this is the very large quantity of lead sold at the average price, and the large quantity of lead products sold, based on the average price of pig lead. To my mind the American business man does not adhere to a system year after year unless a decided benefit is derived from the operation of that system.

Second, the average market price of pig lead should be determined by some agent or agency situated in the city of New York. New York City has become the market place for non-ferrous metals: the sellers of over 90 per cent of the pig lead made in the United States and Mexico have their main sales offices in New York, and by far the largest tonnage of lead bought is bought by buyers with offices in that city. During the last ten years many large corporations have moved their purchasing departments to New York, and many others obtain lead quotations through their New York sales offices.

Third, the average price of lead should be determined by some agency that is not controlled or influenced by either producers, consumers, traders, or brokers.

Fourth, the daily price of lead should be determined on some day following the day under consideration, as quotations are usually not made until the noon hour, and acceptances seldom received before 4 or 5 p.m., and often, when by wire, not until the following morning.

Fifth, the price should be made by an agency determined to arrive as closely as possible at the truth; an agency that is willing to devote time, thought, work, and expense unsparingly, and that will go to the extent of calling on producers and consumers personally, and if necessary asking to see their sales books or contracts.

The staff of the *Engineering and Mining Journal* has its principal office in New York City, and it is neither controlled nor influenced by any group of producers, traders, or consumers. Its policy is to determine the price for one week on the last day of said week, and in my opinion it has spared neither time, thought, nor expense in determining the price by personal visits to producers, traders, and consumers.

From the standpoint of the trade I therefore consider that the *Journal* is the best-fitted agency to determine the average price of lead, and I sincerely hope that from the standpoint of the *Journal* you will decide that the high ideals and reputation of the paper make it the logical medium for determining this information.

The difficulties of ascertaining the average price of lead are numerous. In the first place there is the spot price, the price for the current and succeeding month, the future price, calling for shipment from two to six months ahead, the price of the A. S. & R. Co., the outside price for all domestic lead, the prices for duty-paid lead from Mexico, Australia, London and Spain, and the prices of special brands, all of which should receive a certain amount of consideration. The situation is further complicated by the necessity of having the two basing points, namely, St. Louis and New York.

Taking these prices in order: The spot price is the price that must be paid for lead already at the point of delivery. This price recently has been much higher than shipment lead, although there have been times in the last eighteen months when spot lead sold at a considerable discount. Small consideration should be given to spot prices, as when spot sells at a premium it is obviously unfair to penalize a consumer, which in October, 1919, for instance, contracted for its entire 1920 requirements at the *Journal's* monthly averages, by making this forehanded consumer pay the premium that must be paid by the consumer that waited too long for the price to go down before ordering its requirements.

The price for shipment lead, thirty to sixty days, I believe should be the main basis for the average, as the majority of consumers who buy at a fixed price buy lead for shipment in the current month or that following.

The future price should be given little consideration, as the average for July is the price that the producers are to receive, and that consumers are to pay, for the lead that is actually shipped in July. If September-October shipment lead is selling at a discount I do not think that that fact should reduce the price that the producer is receiving for daily shipments in July. It might be well to follow London's custom, quoting two daily prices, prompt and future shipment.

The price of the A. S. & R. Co. is a price that should receive consideration, especially if this company is selling lead for prompt to sixty-day shipment at this price. Some of the daily trade papers, as you know, quote two prices, one referring to the A. S. & R. Co. price, and one to the "outside price." As your price is the average price, and is not given as a daily market guide to buyer and seller, but as a record of actual sales over a period that has passed, it seems impossible to dodge the issue by quoting two prices for delivery at the same point.

The "outside price" should receive consideration depending on the tonnage sold, in comparison with the total sales. The price for duty-paid lead is very important, as at present large tonanges of it are sold for domestic consumption. The price of special brands should figure in the average after deducting the usual premium.

The temptation of the daily trade papers, I think, is to overquote the market, as it pleases the buyer to think he has bought below the market, and a seller never seems to object to seeing high prices quoted by the daily press. This tendency, of course, is likely to bring criticism of your prices from the mining fraternity.

My suggestion to you would be to quote the market on Wednesday only up to the Tuesday preceding, and my advice to producers, sellers, and consumers is to give you all the information they have concerning sales and purchases, including all the conditions of same, and to assist you in every way to do the valuable and thankless task that you have undertaken. X.

New York.

[1]Or mudslinging editors?—EDITOR.

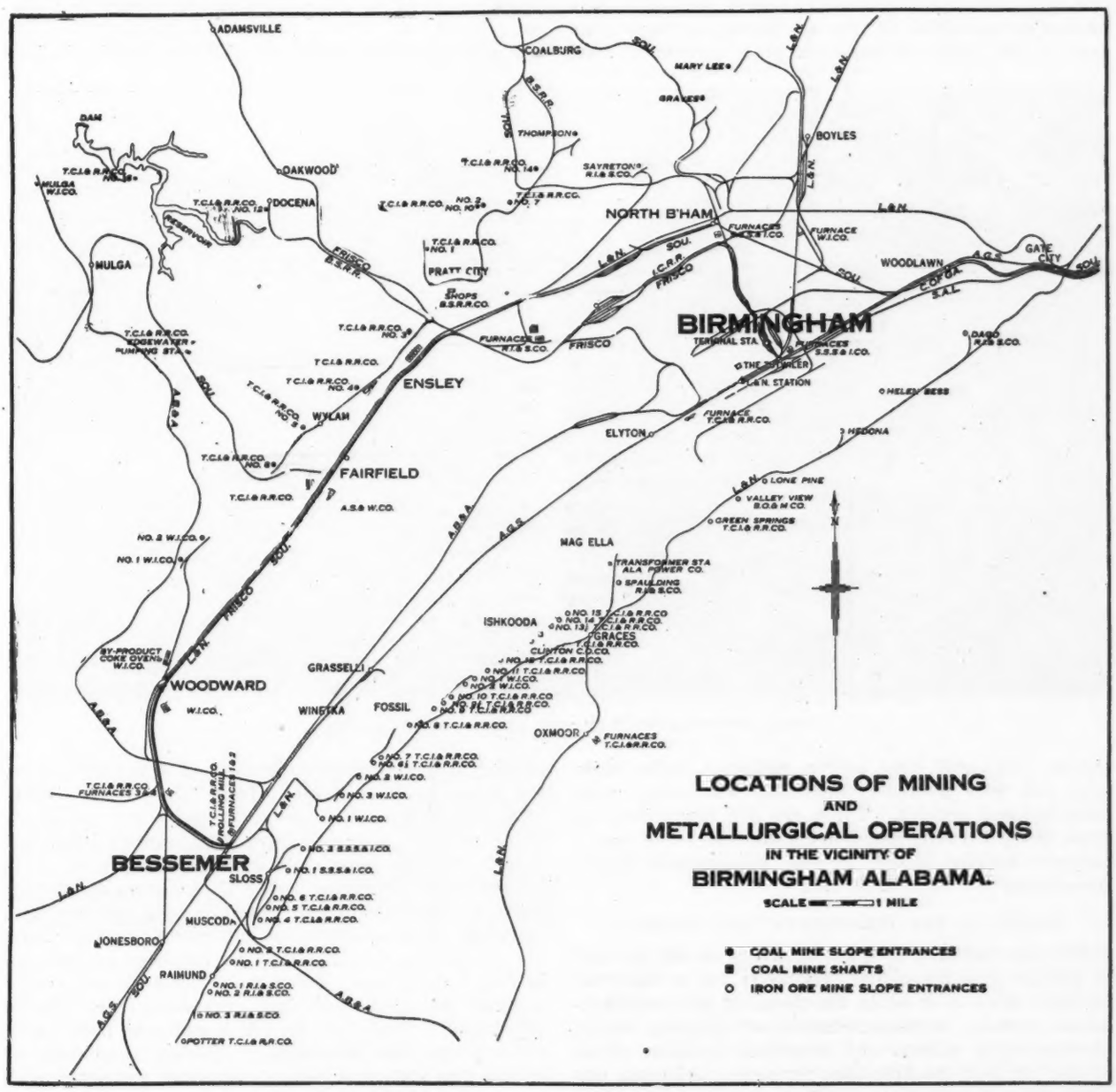
Iron Mining in the Birmingham District

Region Is a Raw-Mineral Producing and Manufacturing Center—Products Are of Varied Nature And Include Pig Iron, Coke, Coal, and Dolomite—Mining Methods Undergoing Changes

BY GEORGE J. YOUNG
Written for *Engineering and Mining Journal*

THE region in and about Birmingham, Ala., is attractive. The relief is low, wide valleys and ridges of moderate height predominating. The country is well wooded, and to a mining engineer accustomed to the more accentuated and scantily clothed topography of the West a visit to the district leaves the impression that the region is an ideal one both in the beauty of the surroundings and the ease of living.

Few mineral regions are as self-contained as is the mineral-bearing area of Alabama. A methodical chemist before undertaking a campaign of work surveys his field, determines what reagents and apparatus he must use, and then assembles them as close as convenient to his work bench. He is then ready to turn out his results with a minimum of footsteps and a maximum of celerity. In the vicinity of Birmingham there are extensive workable beds of iron ore, the edges of which outcrop on Red Mountain; thick beds of dolomite and limestone, which reach the surface at convenient places; and extensive coal fields which supply an excellent



metallurgical coke. All four of these fundamental reagents occur within an area which can be and is readily served by railroad transportation. The remaining two necessary reagents, enterprise and a population sufficient to yield the required labor, are also present.

Pig Iron and Steel Principal Products

The output is pig iron and steel. Industrial development has reached a point where a considerable part of the raw iron and steel production is placed upon the freight car in the form of manufactured products. It is an industrial principle to advance a basic raw product as far as practicable on its course into finished or salable products as close to the point of production as possible. Birmingham places pig iron and steel of various grades upon the freight cars, but each year increasing quantities of iron are placed on these same cars in the form of cast-iron pipe, structural steel shapes, fabricated steel, stoves, radiators, bolts, nails, wire and wire products, machinery and many other manufactured articles. There are 348 manufacturing firms in the Birmingham district, and the list of manufactured articles issued by the Birmingham Traffic Association is a formidable one.

OPEN-PIT WORKINGS IN THE BIRMINGHAM DISTRICT

History of the Birmingham Iron District

The iron industry of Birmingham is an old one and is passing into its second childhood; and a vigorous, youthful growth it is, in the form of new establishments, greater mechanicalization of existing works, manufacturing plants, and improved facilities of all kinds. In 1818 the first blast furnace in Alabama was blown in at Russellville; in 1827 the first coal was mined in the Warrior coal field; in 1854 the first coke was made from Alabama coal for foundry use; in 1858 the first rolling mill was built at Shelby; in 1864 red hematite from Red Mountain was first used; in 1871 Birmingham was founded; in 1878 the first coke pig iron was made at Oxmoor, on the south side of Red Mountain, eight miles from Birmingham; in 1879 the first rolling mill was built in Birmingham; in 1888 the first steel was made in Birmingham, and in 1895 basic iron was first made. The present decade is marked by the conspicuous introduction of byproduct coke ovens and numerous manufacturing plants as well as the material improvement and modernizing of those in operation.

Two important sources of information on this district are to be found in Bulletin 400, U. S. Geological Survey, written by Ernest F. Burchard, Charles Butts, and Edwin C. Eckel, and Geological Folio No. 175, written by Charles Butts. Both were published in 1910, and are exhaustive in their respective fields. In *Mineral Resources* production statistics can be found for different periods.

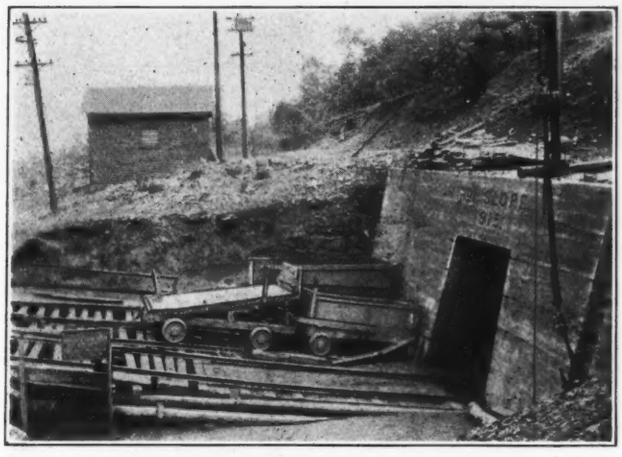
The hard and semi-hard ore mined in the Birmingham district is of non-bessemer grade and shows the following range in composition: Iron, 32 to 35 per cent; lime, 5 to 20 per cent; silica, 2 to 25 per cent; alumina, 3 to 5 per cent; magnesia, 1 to 3 per cent; phosphorus, 0.25 to 1.25 per cent, and sulphur, from a trace to 0.5 per cent. According to the U. S. Geological Survey Bulletin 400 "the ore beds are usually overlain and underlain by comparatively impervious shales. Near the surface the calcium carbonate has been leached out, leaving a richer ore. Below water level the ores carry a higher per cent of calcium carbonate. The Clinton (Rockwood) formation, in which red ores occur, consists, within the Birmingham district, principally of overlapping lenticular beds of sandstone and shale, with four well-marked horizons of iron ore, generally in the middle one-third of the formation." The following description covers the two more important "seams" and is taken from the bulletin just mentioned:

> The Big and Irondale seams are considered together. The ore, however, is different in quality, and the beds are

so sharply separated by sandstone or shale that they may be mined independently. The thickness of the Big seam varies from 16 to 30 ft. It exists on Red Mountain for practically the whole length of the mining district; notwithstanding the great thickness there are rarely more than 10 or 12 ft. of good ore in a single bench, and at most places only from 7 to 10 ft. are mined. From northeast to southwest the total thickness of the ore-bearing sediment gradually decreases, without, however, altering greatly the thickness of the workable portion. About the middle of

TYPES OF UNDERGROUND ORE CARS

the district the bed becomes separated into two benches, either by a well-defined parting along the bedding plane or by a shale bed, thin at first but thickening gradually to the southwest. The middle of the Big seam is the workable part in the northeast end of the district, but the upper bench is of the most importance throughout the rest of the area. In the southwest portion of the district the lower bench, which farther northeast is composed of ore that may be eventually mined, becomes a series of thin strata of lean ore and shale, and is consequently of no possible value; and, finally, the upper bench itself becomes shaly



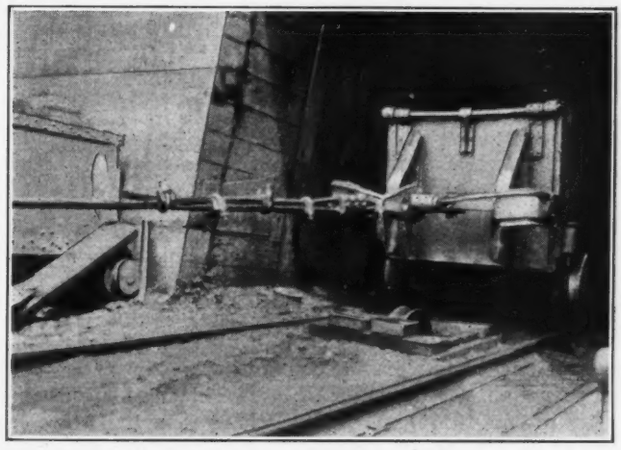
ENTRY TO RAIMUND NO. 1 SLOPE

and carries only a very low-grade ore. The Irondale seam is of most value along Red Mountain between Pilot Knob on the northeast and Lone Pine Gap on the southwest.

The merchantable ore seam averages ten feet in thickness and dips to the southeast at angles varying from 12 to 45 deg. Red Mountain lies southeast of Birmingham and Bessemer and extends northeasterly and southwesterly. Mining extends from a short distance southwest of Raimund to a point east of Birmingham. This distance is approximately fifteen miles. The Clinton formation occurs at other points in the state, and iron ore is mined where the ore beds reach a mineable thickness.

Bulletin 400 presents an estimate of the iron ore available. Of ore of a minimum workable thickness, or within a maximum distance from the outcrop practicable for mining, there is 458,470,700 long tons. In this estimate the distance measured along the dip for purposes of estimation ranged from 3,100 to 6,000 ft. The estimated red-ore reserves in the lower bench of the Big Seam in Red Mountain and Shades Valley is 146,024,700 long tons. The distance on the dip used in this estimate ranges from 5,200 to 6,000 ft. The estimated red-ore reserves, not at present available, in the eastern part of Shades Valley is 292,401,400 long tons. The distance on the dip used in this estimate ranged from 3,500 to 20,000 ft. The computed length of outcrop in all three classes of ore reserves measured respectively 167,200, 60,900, and 161,900 ft. The grand total is 796,896,800 long tons. A more recent compilation would probably enhance this total.

There are three coal fields, the Warrior-Plateau, the Cahaba, and Coosa. The Warrior field is the most



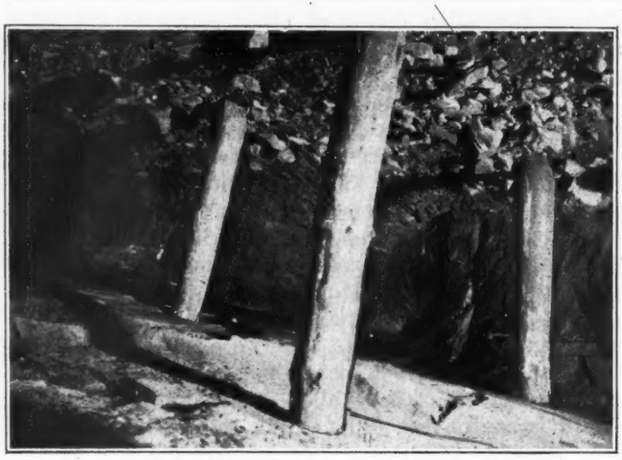
THE SKIP COMING UP THE INCLINE

important and covers an area of 7,845 square miles. This field supplies the coking coals. The Pratt and Blue Creek seams, which range from three to six feet in thickness, are the important producing seams. The coal is washed to obtain a low-ash coke. Analyses are as follows:

	Ash, Per Cent	Volatile, Per Cent	Sulphur, Per Cent	Fixed Carbon, Per Cent
UNWASHED COAL				
Pratt	8.27	30.10	1.53	61.60
Blue Creek	15.76	23.97	0.86	60.27
WASHED COAL				
Pratt	5.29	30.80	1.28	63.90
Blue Creek	7.93	25.61	0.79	66.46

The Cahaba and Coosa fields are of less importance. According to the annual report of coal mines of Alabama for 1918 there were 7,269 coke ovens, both beehive and byproduct. Of these over 847 were byproduct, and in that year 2,611,215 tons of coke was produced by byproduct ovens and 1,733,511 by beehive ovens.

Both dolomite and limestone occur in beds of minable thickness. Dolomite is used largely as a flux. A representative analysis is as follows: Silica, 0.55 per cent; alumina, 0.41 per cent; lime, 31.48 per cent; magnesia, 20.11 per cent; iron, 0.10 per cent. At Ketona and Dolcito, seven miles north of Birmingham, are large quar-



TIMBER PROPS IN ROOMS

ries. The quarry work is on a large scale, and the deposits are such that high benches are broken and little stripping is necessary.

Production of iron, steel, and coke is given in Table I.

TABLE I. IRON, STEEL AND COKE PRODUCTION OF THE BIRMINGHAM DISTRICT

	Tons Produced		
	Iron	Steel	Coke
1913	2,025,378	778,390	3,526,624
1914	1,826,929	525,770	3,092,771
1915	2,049,453	715,485	2,780,976
1916	2,762,895	1,099,649	4,298,589
1917	2,953,705	1,188,074	4,892,589
1918	2,587,852	1,074,324	4,344,726
1919	2,130,092	1,045,115	4,000,000

The total iron ore mined in Alabama (U. S. Geological Survey) in 1917 was 7,101,586 long tons, of a value of $13,049,535. In 1918 the tonnage dropped to 6,121,087, but the value reached $15,334,561. Of the total ore mined in 1918, a total of 4,985,557 long tons was hematite and 769,067 long tons was brown ore. The Birmingham district supplied 5,728,862 long tons of hematite ore in 1917 and 4,763,057 long tons in 1918. In the U. S. Geological Survey's list of iron-ore mines in the United States that produced more than 50,000 gross tons each in 1918 the following mines in Alabama are recorded:

IRON MINES IN ALABAMA IN 1918

Rank	Name of Mine	Nearest Town	Quantity Mined, Long Tons
2	Red Mountain Group	Bessemer	2,376,974
21	Woodward 1, 2 and 3	Lipscomb	718,237
32	Sloss Nos. 1 and 2	Bessemer	502,069
68	Songo	Songo	242,549
77	Russellville (*a*)	Russellville	516,611
96	Spaulding	Birmingham	168,195
118	Raimund No. 1	Bessemer	128,379
133	Hammond	Hammond	118,464
138	Greeley (*a*)	Greeley	113,203
142	Steiman	Steiman	109,222
148	Attala No. 1	Attala	102,938
158	Raimund No. 2	Bessemer	94,347
189	Ironaton (*a*)	Ironaton	57,530

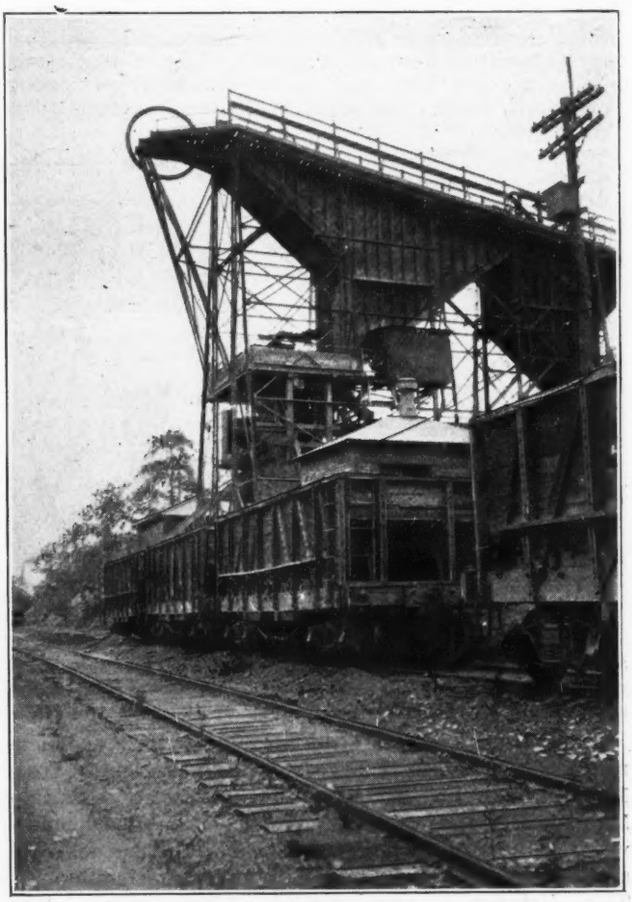
(*a*) Brown ore.

At present twenty-six blast furnaces are in operation in Alabama, and during May the blast furnaces in the Birmingham district reached a production of 18,000 tons of pig iron per month. The largest company is the Tennnessee Coal, Iron & R.R. Co., which had in May five blast furnaces producing basic iron at Ensley, one on basic at Alice, and one on foundry pig at Alice. The Sloss-Sheffield has five active blast furnaces, one each at North Birmingham, Sheffield, and Florence, and two in Birmingham. The Woodward Iron Co. has four active blast furnaces, one on basic and three on foundry pig. The Alamaba Co. is operating two blast furnaces at Gadsden. The Central Iron & Coal Co. at Holt, the Jenifer Coal & Iron Co. at Jenifer, and the Woodstock Iron & Steel Corporation at Anniston are each operating single blast furnaces at the respective points named. The Republic Iron & Steel Co. has three blast furnaces at Thomas. The Woodward Iron Co. has three blast furnaces at Woodward and two at Vanderbilt. All of these companies operate iron mines and practically all work coal mines also.

MINING IN BIRMINGHAM DISTRICT

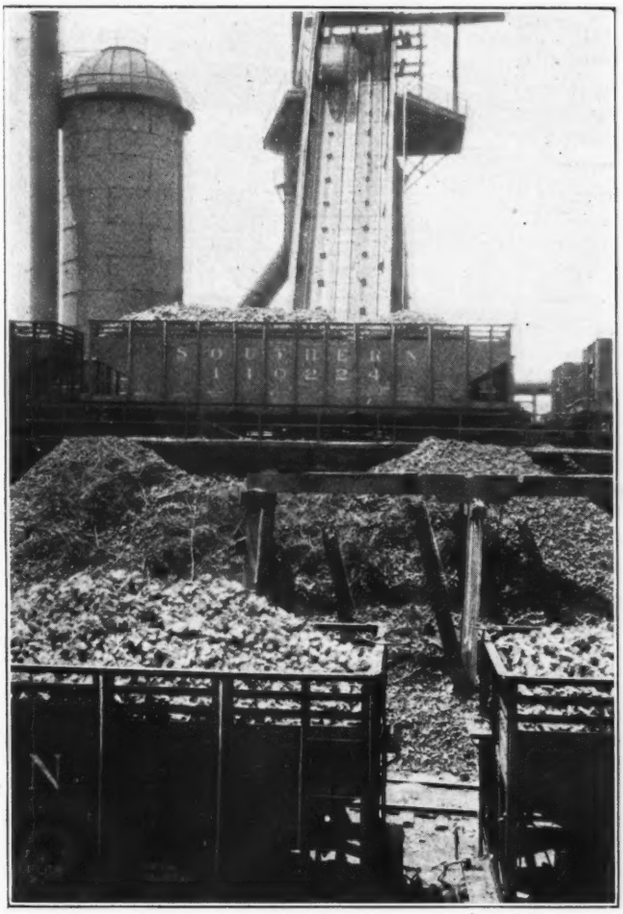
Mining in the Birmingham district involves the winning of a deposit of comparatively uniform thickness ranging from eight to ten feet, dipping at an angle varying from 15 to 45 deg., averaging between 18 and 30 deg. The ore is of medium hardness. The roof and floor conditions are usually good. Faults occur at different places, interfere with the regular system of mine layout, and necessitate auxiliary hoisting and rehandling of ore. Drainage and ventilation involve no special problems.

Mining methods fall into four groups, the sequential order of which represents their development in point of time. The first method, stripping overburden and mining the ore by open-pit, is practiced to some extent, but is relatively unimportant now. The second method, consisting of a combined open-cut and underground operation, is taken advantage of where topographical conditions admit of the construction of an incline tramway in conjunction with entries or drifts extended along the strike of the ore bed. The third method is systematic underground mining, in which entries or drifts are



HEADFRAME AT NO. 1 RAIMUND MINE

turned off at intervals of sixty feet from a slope. The drifts are driven narrow for a distance of 75 ft. and then widened out to 30 ft. In the more recent examples of this method the slope is sunk in the foot wall, ten feet below the ore seam, as a single-track skipway, a manway being provided alongside or in a parallel slope. In this arrangement the cars used for transportation on the entries are dumped directly into the skip. The skips are from ten- to twelve-ton capacity. In still more



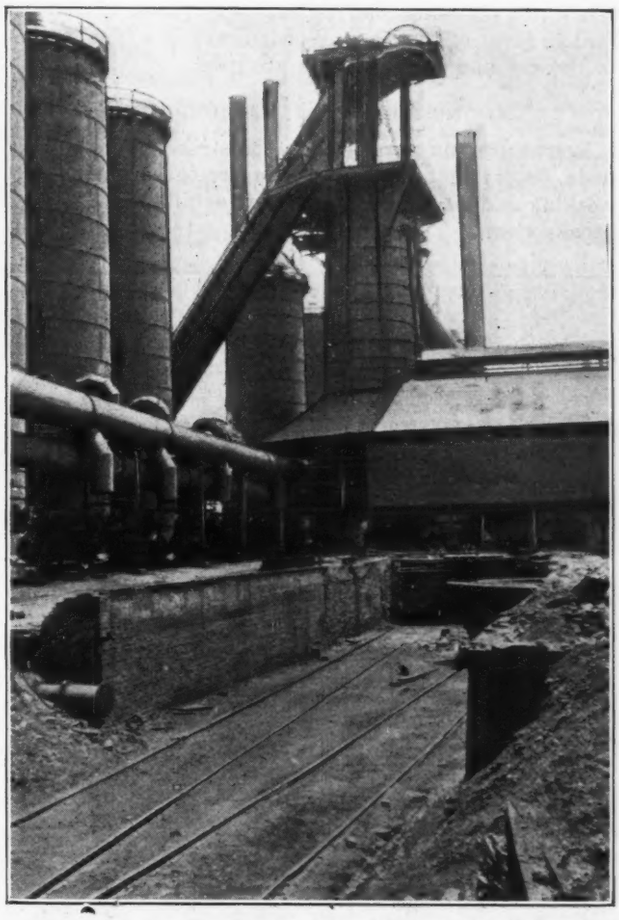
COKE AND IRON ORE AT SKIPWAY OF FURNACE

recent slope installations pockets are put in at slope loading points and skips are loaded from chutes. The fourth method, which utilizes a vertical shaft for working purposes, is just coming into vogue. The Woodward Iron Co. has recently constructed a vertical shaft.

T. C. I. & R.R. Co. Has Standardized Plants

The Tennessee Coal, Iron & R.R. Co. has fourteen active mines and has standardized both its equipment on surface and underground and its mining methods. A brief description of the surface plant of No. 4 mine will indicate the most advanced plant practice in the district. The output of this mine is 3,000 to 4,000 tons per day, about 1,300 men being employed. Power is supplied by the Alabama Power Co. at a line voltage of 44,000 volts reduced to 2,200 volts. Two Nordberg steam-driven air compressors have been converted to electrically-driven compressors by disconnecting the steam cylinders and placing a 700-hp. synchronous motor on the flywheel shaft. The hoist is single-drum (single hoisting rope), steam-driven, and direct-connected. The steam cylinders have been disconnected and a motor connected up by a single reduction Wuest gear to the crank pin of the drum by means of a short drag-link. This method of converting a steam-driven into an electrically-driven hoist involves the minimum change in the mechanism of the unit. The acceleration period is eleven seconds and the full rope speed is 2,700 ft. per minute. Only sufficient boiler capacity to supply steam for heating and that required in the change house has been retained. A change house, one section for blacks and one for whites, is provided close to the shaft mouth.

The shaft is timbered and divided into a footway on the left and a hoisting compartment on the right. The skip track is of five-foot gage. The skips are twelve-ton capacity (this size is used in all mines of the T. C. I. & R.R. Co.). The skip has a wire safety rope arranged as a bridle around the body of the skip. Hoisting ropes are $1\frac{3}{8}$ in. in diameter. Men are handled to and from their work in the skip. Electrical haulage is not used underground. Small 100-gal. pumps are electrically-driven triplex, but the standard 1,500-gal. pump is an electrically-driven horizontal duplex plunger machine. In ten of the mines of the company the pumping has



BLAST FURNACE AND HOT BLAST STOVES

been electrified, but in only one has the surface plant been electrified, all of the others being steam driven and provided with the necessary boiler plants.

At the Muscoda No. 2 two shafts are served by a single boiler plant, which is placed midway between the two outlets. Both hoists are placed at the boiler plant, and the hoisting ropes are conducted on sheaves to the respective headframes.

The handling of the ore at the surface is done by

dumping into a chute leading to a No. 8 gyratory crusher, which discharges directly into railroad cars. Jackhammers, piston, and hammer drills are used underground. The company rolls its own drill steel, which is solid. Blasting is done at the end of the shift, and 35 per cent gelatine dynamite is used.

At the Raimund No. 1 and No. 2 mines, operated by the Republic Iron & Steel Co., both of the surface plants are steam driven. First-motion hoists, single-drum and single-rope operated, are used. At the Raimund No. 1 the headframe is of steel construction. A ten-ton skip is used, and eight tons is hoisted at a load. At a station the cars are dumped by means of a cradle dump, which discharges into a pocket, from which the skip is loaded by means of a measuring pocket. The trackage arrangement is similar to that used in a coal mine. The loaded cars approach the dump on a down grade and are shunted back over a switch and short curved track on a down grade to the empty track, from which they are hauled back into the workings by mules. From the main drifts the cars are lowered and raised on auxiliary slopes to the working levels by electrical or air hoists. Grades to the main shaft station vary from 2 to 3 per cent in favor of the load. Wooden cars of a type similar to those found in coal mines are used.

Mining Method at Raimund Mine

Rooms are run parallel with the strike and are 30 ft. wide, 60 per cent of the ore being removed on the first working and 40 per cent being left as pillars. The roof breaks clean. Two lines of props without headboards

A LITTER OF PIGS IN THE BIRMINGHAM DISTRICT

BREAKING PIGS AND SOWS APART

are used in the rooms. The roof does not show pressure. The ore thickness mined is eight feet. Tripods are used for the support of the machines in all room work. Leyner-Ingersoll, Dreadnaughts, and Turbos are used for drilling. Jackhammers are used for blockholing and drifting. At this mine preparations were being made for underground trolley transportation. Only one mine, the Spaulding, owned by the same company, is equipped with trolley-wire transportation underground. At the Raimund mine a number of faults have made the workings more irregular than at other properties. Repeated handling of the ore is frequently the outcome of the necessity for working isolated lengths of ore bed, elevated out of the normal dip line by a fault.

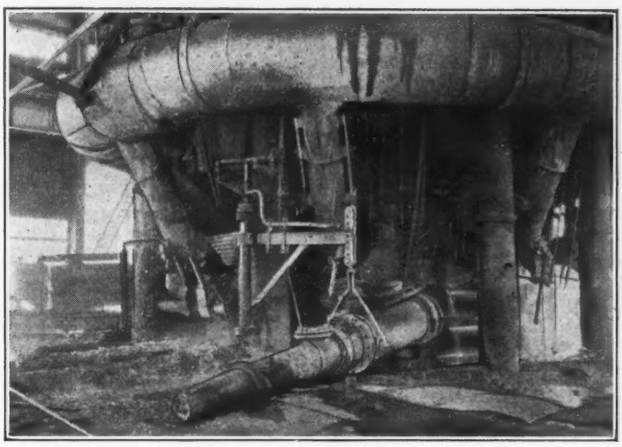
Opportunity for Use of Power Appliances Underground

The mining methods in the Birmingham district are noteworthy, from the viewpoint of the metal-mining engineer, for their simplicity and close relationship to methods used in coal mining. Only in breaking and skip haulage is there any considerable departure from coal-mining methods. The necessity for the use of negro labor and proximity to coal-mining areas greatly influenced present methods. Undoubtedly the succession of changes will lead to greater introduction of power appliances underground, with a reduction in the proportion of hand labor. This will throw upon the companies the necessity for training their raw labor in the use of such appliances.

Mucking machines and underground electrical haulage will be introduced to expedite underground handling of

ore. The use of chutes from intermediate levels and the concentration of hoisting from main-level pockets instead of from all working levels will increase hoisting capacity. The introduction of two-compartment skip hoisting will increase shaft capaicty, and in conjunction with underground electrical haulage will enable a greater area of bed to be served by one shaft.

Complete electrification of surface plant and underground haulage and pumping will obviate the necessity of the individual steam plants which are largely used at present. A central power plant to serve the area should prove economical. Vertical shafts will be used to a greater extent in this district. At present development and mining proceed from the slope or shaft outward. The future mining will be be to push broad-scale development to the limits of the individual mining unit and to adopt a retreating system of mining in which all of the minable ore will be removed instead of leaving pillars, representing 40 per cent of the ore, to be subsequently won. The foregoing are features which



IRON TAP BLAST FURNACE, SLOSS-SHEFFIELD PLANT

appear to me to represent the improvements which higher wages and increasing costs will necessitate. The great limitation to the introduction of systematic mining of the kind indicated is the employment of negro labor, and improvement in practice will depend in large measure upon its ability to respond to the more highly specialized demand that will of necessity be put upon it.

The Gulf Sulphur Region*

Until 1904, the production of sulphur in the United States was considerably less than 10,000 tons per year, and the bulk of our requirements had to be imported from Sicily. From 1904 to 1914 the United States produced enough for its own use, and at the end of this period was supplying Canada, had begun actively to enter the French and German market, and, in addition, had accumulated a reserve stock, in the hands of the producers, of approximately one million long tons. Figures recently made public in connection with litigation over patent rights show that half of this stock was accumulated in a single year, 1912, when production reached 790,000 long tons, of which only 300,000 tons was marketed and the balance of 490,000 tons went into storage. The United States production has exceeded that of Italy since 1912, although the sales have been less, because sulphur was being withdrawn from stocks in Italy while stocks in the United States were being increased. The net effect of the war was a four-fold increase in the amount of sulphur sold in the United States, without any reduction in stocks, while in Italy production fell off 50 per cent, and stocks on hand were reduced by the same percentage.

From 98 to 99 per cent of the United States production has come from the Gulf coast region of the states of Louisiana and Texas. A number of other localities in west Texas, Colorado, Wyoming, Idaho, and Nevada have surface deposits, usually of limited extent, which have been worked on a small scale, but have declined in importance with the development of the better-grade and more accessible deposits of the Gulf Coastal region.

The occurrence of sulphur in the Gulf Coast region is in connection with a peculiar formation known as "saline domes" or "mounds." Over twenty of these domes have been located, scattered in an area 200 miles long, extending through western Louisiana and eastern Texas, and generally within fifty miles of the Gulf of Mexico. Commercial deposits of petroleum, sulphur, and salt have been developed in connection with the domes, but so far not more than one of the minerals has been developed to commercial degree in a single dome. Sulphur was discovered when drilling was being carried on for oil. So far, three domes have been developed for sulphur, namely that owned by the Union Sulphur Co., at Sulphur, La. (1903), that owned by the Freeport Sulphur Co., at Freeport, Tex. (1912), and that of the Texas-Gulf Sulphur Co., near Matagordo, Tex. (1919). Two other domes are under exploration and a number of others may possibly contain sulphur.

The sulphur occurs at a depth of 300 to 1,200 ft., and is associated with limestone and underlain by gypsum. The surface area of the producing domes varies from 200 to 1,500 acres. Exploration is done by drilling at a cost of $200,000 to $300,000, and the cost of a complete plant is several million dollars. The sulphur cannot be mined by shafts, owing to the quicksands and the poisonous gases encountered. The deposit at Sulphur, La., remained unworked for almost forty years after its discovery before a satisfactory process was developed to mine it. This is known as the "Frasch process" and consists of the sinking of wells to the sulphur deposit, each well being lined with a 10- to 12-in. pipe. Smaller pipes are placed inside, so that superheated water can be brought in contact with the sulphur ore, which is melted and forced to the surface by compressed air. The sulphur on cooling is ready for market and is over 99 per cent pure.

Each of the three plants in operation is equipped with a boiler capacity of over 20,000 hp. for superheating the water, and requires about a million and a quarter barrels of fuel oil per year. The origin of these domes is believed to be due to deep-seated igneous intrusions, resulting in the alteration of gypsum and the crystallization of salt and sulphur which has caused an upbowing of the strata. Because of the nature of the formation and the irregularity of the deposits it is impossible accurately to estimate the reserves of sulphur.

With the addition of two new plants since 1912, the United States now has a sulphur-producing capacity of about 1¼ million tons per year, or four times the normal sales before the war.

*A. G. White, in "Political and Commercial Geology." McGraw-Hill Book Co., 1920.

(Photo by Crane)

POLK SOUTHARD MINE, OPERATED BY STEAM SHOVEL, IN RESIDUAL CLAY OF FERNVALE LIMESTONE. BATESVILLE DISTRICT, ARKANSAS

Manganese Ores of the Southern States

Their Combined Output Greater Than Half Total Production of This Country—Character of the Deposits and Mode of Occurrence of Ores in Southern Appalachian and Arkansas Districts

BY GEORGE W. STOSE*
Written for *Engineering and Mining Journal*

DEPOSITS of manganese ore in commercial quantities occur in several of the Southern states, chiefly in Virginia, Georgia, Tennessee, and Arkansas. A small quantity of manganese ore was mined as early as 1840, but it was not until 1866 or 1867 that production in any of the Southern states was appreciable. Deposits in Virginia, Georgia, and Arkansas were early exploited, and up to 1914 their combined output was 94 per cent of the total manganese ore produced in the United States, with the bulk of it coming from Virginia. From 1903 to 1914, 90 per cent of the production of the United States came from Virginia alone.

Since 1914 the increased demand for domestic ore due to the World War gave renewed stimulus to the industry and excited the search for manganese ore deposits throughout the United States, which resulted in the development of mines in many other states, particularly those in the West. A market was also created by the war for low-grade manganese and manganiferous iron ores, and such ores were mined in considerable quantity also in the Southern states. Table I shows the production of manganese ore in the Southern states as compared with the total production of the United States.

The prices of ores which obtained during the war rose to between $35 and $55 a ton for the general run of ore of this region, and some of the highest grade of metallurgical ore commanded as high as $75 a ton. At the close of the war, the steel manufacturers and dealers in ferromanganese refused to buy domestic manganese ore at any price, and the domestic manganese industry thereupon practically collapsed. Considerable mining was continued until July 1, 1919, in Virginia and some in Arkansas under war contracts. Since the first collapse of the market the price of ore has increased, and at the present rate of 80 to 90c. a unit for high-grade ore, manganese mining has been revived in many parts of the Appalachian states and in Arkansas, whereas few of the Western mines have been able to operate profitably. So, Virginia and others of the Southern states will probably again become the chief producers of manganese ore in the United States.

Practically all the commercially developed manganese deposits in the Southern states are oxide. A few deposits in Arkansas and Tennessee are in part carbon ores, and several small silicate deposits are known in the Appalachian Mountains or Piedmont Plateau. Most of the manganese oxide deposits are mined by open-cut methods, underground working being limited to a few mines. In most plants the only machinery employed is a log washer, although a few are equipped with jigs and tables. Practically all of the mining rights are acquired

*Published with permission of the Director, U. S. Geological Survey.

by lease. The royalty paid generally ranges from 25c. to $1 per ton, but as much as $4 a ton was paid during the war for some high-grade lump ore in Bradley and Monroe counties, Tenn.

ganese carbonate ores which resemble rhodochrosite but contain also calcium and magnesium carbonates, and some manganese silicate minerals.

The manganese deposits occur chiefly in the eastern

TABLE I. PRODUCTION OF MANGANESE ORE IN THE SOUTHERN STATES, 1838-1918

In Long Tons

Year	Alabama	Arkansas	Georgia	North Carolina	South Carolina	Tennessee	Virginia	West Virginia	Other States	Total
1838-1879	....	610	(*a*) 19,950	...	....	....	(*b*) 18,000	...	(*b*) 5,500	44,060
1880	....	.....	1,800	...	....	....	3,661	...	300	5,761
1881	....	100	1,200	...	....	....	3,295	...	300	4,895
1882	....	175	1,000	...	....	....	2,982	...	375	4,532
1883	....	400	(*c*) 400	(*c*)	....	....	5,355	...	.....	6,155
1884	....	800	(*c*) 400	(*c*)	....	....	8,980	...	.....	10,180
1885	....	1,483	2,580	...	....	....	18,745	...	450	23,258
1886	75	3,316	6,041	14	.....	50	20,567	...	130	30,193
1887	....	5,651	9,024	14	....	....	19,835	...	.....	34,524
1888	....	4,312	5,568	(*d*)	....	(*d*)	17,646	...	1,672	29,198
1889	....	2,528	5,208	47	124	30	14,616	...	1,644	24,197
1890	....	5,339	749	14	....	....	12,699	...	486	19,287
1891	....	1,650	3,575	...	....	....	16,248	...	979	22,452
1892	....	6,708	826	...	....	....	6,079	...	.....	13,613
1893	....	2,020	724	...	....	482	4,092	...	400	7,718
1894	....	1,934	1,277	...	....	922	1,797	100	278	6,308
1895	....	2,991	3,856	...	....	....	1,715	...	985	9,547
1896	....	3,421	4,085	2	....	....	2,018	13	549	10,088
1897	....	3,240	3,332	...	....	11	3,650	...	875	11,108
1898	22	2,662	6,689	...	....	381	5,662	...	541	15,957
1899	....	356	3,089	90	....	19	6,228	10	143	9,935
1900	....	145	3,447	...	....	30	7,881	...	268	11,771
1901	17	91	4,074	...	...	400	4,275	...	3,138	11,995
1902	....	82	3,500	...	8	....	3,041	...	846	7,477
1903	....	.....	500	...	25	....	1,801	...	499	2,825
1904	....	.....	.....	...	....	....	3,054	...	92	3,146
1905	....	.....	150	...	....	20	3,947	...	1	4,118
1906	....	62	.....	...	....	30	6,028	...	801	6,921
1907	....	.....	.....	...	800	100	4,604	...	100	5,604
1908	....	.....	.....	...	....	....	6,144	...	.....	6,144
1909	....	.....	.....	...	....	(*e*)	(*e*) 1,544	...	.....	1,544
1910 (*f*)	....	500	.....	...	....	....	1,758	...	.....	2,258
1911	....	.....	.....	...	....	....	(*g*) 2,457	...	.....	2,457
1912	....	.....	.....	...	(*h*)	....	(*h*) 1,664	...	.....	1,664
1913	....	.....	.....	...	.....	....	4,048	...	.....	4,048
1914	....	.....	.....	...	410	....	1,724	...	501	2,635
1915	200	1,288	3,168	...	....	.....	1,620	...	3,132	9,408
1916	(*i*)	6,318	(*i*)	....	.....	212	4,388	...	16,266	27,184
1917	264	10,140	3,614	102	405	1,996	12,360	...	100,524	129,405
1918	709	7,731	6,679	315	100	4,162	10,928	....	275,245	305,869
Totals.....	1,287	76,053	106,505	598	1,872	8,845	277,136	123	417,020	889,439

(*a*) Production began in 1866. (*b*) Production began in 1867. (*c*) Georgia includes North Carolina. (*d*) Included in "Other States." (*e*) Virginia includes Tennessee and other states. (*f*) 1910 to 1918, marketed production is recorded. (*g*) Virginia includes other states. (*h*) Virginia includes South Carolina and other states. (*i*) Included in "Other States."

The manganese minerals are chiefly oxides, four of which—psilomelane, manganite, pyrolusite, and wad—are commonly present, and two others—hausmannite

part of the southern Appalachians and in Arkansas. I am personally familiar with only the deposits of the Appalachian region, and so have drawn on the reports

SPHEROIDAL NODULES OF PSILOMELANE, INCLOSED IN CRYSTALLINE MANGANITE. FROM ORISKANY SANDSTONE, POWELLS FORT MINE, MASSANUTTEN MOUNTAIN, VA.

CONCENTRICALLY BANDED DENSE PSILOMELANE AND COARSELY CRYSTALLINE MANGANITE FILLING CAVITIES. FROM CLAY OF FORT PAYNE CHERT, COOK MINE, WALNUT GROVE, ALA.

and braunite—occur in certain districts. Some ores are mixtures of manganese and iron oxides which are not definite minerals. There are also present certain man-

by Miser for Arkansas for much of the data secured.

The manganese deposits of the southern Appalachians may be divided into oxide ores, carbonate ores, and

silicate ores. The oxide ores predominate and are the only ones that have been extensively mined. They occur almost exclusively in residual clay or clayey sand derived from the weathering of sedimentary rocks. Most of them lie on the east side of the Appalachian Valley, but some occur within the open part of the valley and others among the ridges on the western side. Nearly all may be classed as secondary replacement deposits, but there have been recognized by geologists, who have recently studied the deposits, ten different modes of occurrences of oxide deposits, depending chiefly on the geologic formations with which the ore is associated.

DRY RUN MINE, NEAR BUTLER, TENN.

The rocks of the southern Appalachian region comprise a thick series of sedimentary origin, chiefly limestone, shale, and sandstone, overlying older crystalline rocks. In general the crystalline rocks occur only in the Piedmont Plateau, including the Blue Ridge and Appalachian Mountains, and the sedimentary rocks chiefly in the Appalachian Valley and Appalachian Plateaus. The oldest sedimentary rocks lie nearer the Appalachian Mountains, and successively younger beds appear toward the northwest, the youngest forming the Appalachian Plateau, but this order is varied greatly by folds and faults which locally reverse and repeat the order many times. The sequence of these rock formations is shown in Table II.

As previously stated, ten different modes of occurrences of manganese oxide deposits in the southern Appalachians have been recognized. Eight of these are directly associated with beds in the geologic formations. The modes of occurrences thus recognized, arranged in the order of their stratigraphic occurrence, with the oldest rocks at the bottom, are as follows:

Deposits along fault planes (in any formation); in terraced stream gravel (Tertiary or Quaternary); in Fort Payne chert (Carboniferous); in Oriskany sandstone (Devonian); in Tellico sandstone and Holston marble (Ordovician); in Knox dolomite (Ordovician and Cambrian); in Watauga shale (Cambrian); in residual clays of the Shady dolomite (Cambrian); in Erwin quartzite (Cambrian), and in old sedimentary schists (probably Paleozoic). The general distribution of areas in which manganese ore occurs in the formation above mentioned is shown in the accompanying map.

The Piedmont Plateau, which lies at the east foot of the Appalachian Mountains, is composed largely of crystalline rocks which inclose narrow belts of sedimentary schists, probably of Paleozoic age, that are manganese bearing. Manganese has been mined along a narrow belt of such schists in Nelson, Buckingham, Amherst, Appomattox, Campbell, and Pittsylvania counties, Va., and to a less degree along similar belts in North Carolina, South Carolina, and Georgia.

At the Piedmont mine recently described by Hewett,[1] the ore is largely pyrolusite, with some psilomelane and wad, lies between a hanging wall of schist and a foot wall of limestone, and has replaced parts of the schist. Large lenses of high-grade ore have been mined to a depth of 170 ft. below water level.

DEPOSITS IN ERWIN QUARTZITE

A few deposits occur in the Erwin quartzite, which generally forms the westernmost ridges of the Blue Ridge. (See map, p. 259.) This quartzite dips under the Shady dolomite of the Appalachian Valley to the west, and in places where the rocks are nearly vertical the

[1] Hewett, D. F., "Some Manganese Mines in Virginia and Maryland," U. S. Geological Survey Bull. 640, pp. 49-54, 1916.

TABLE II. COMPOSITE TABLE OF GEOLOGIC FORMATIONS IN AREAS WHERE MANGANESE DEPOSITS OCCUR IN THE SOUTHERN APPALACHIANS

	System	Formation	Character of Rocks
This pertains to South Tennessee, Northeast Ala. and Northwest Georgia	Carboniferous	Fort Payne chert	Thin bedded chert or cherty limestone. Manganese-bearing in places.
	Devonian or carboniferous	Chattanooga shale	Black carbonaceous shale.
	Silurian	"Rockwood" formation	Sandstone and shale of Medina and Clinton age.
	Ordovician	Sevier shale (*a*)	Yellow argillaceous shale, shaly limestone, and oolitic marble.
		Tellico sandstone (*b*)	Red sandstone and sandy granular limestone. Manganese bearing in southern part.
		Athens shale (not present in southern part)	Fissile shale, absent where Tellico is ore bearing.
		Holston marble (in Chickamauga limestone)	Pinkish and white marble. Ore bearing where Tellico overlaps upon it.
		Chickamauga limestone	Light blue to light gray limestone and shaly argillaceous limestone.
		Knox dolomite	Massive dolomite and limestone containing chert, which carried manganese ore in places.
This part of section pertains chiefly to East Tennessee and south-central Virginia.	Cambrian	Nolichucky shale	Shaly and platy limestone with thin argillaceous layers.
		Honaker limestone: Maryville limestone, Rogersville shale, Rutledge limestone	Limestone, dolomite, and shales.
		Watauga shale	Purple sandy shale, impure limestone, and calcareous sandstone. In places impregnated with ore.
		Shady dolomite	Massive light gray dolomite, and impure argillaceous beds at base. Carries manganese ores in most places.
		Erwin quartzite ..... Hesse quartzite	Hard quartzite and some shale. Brecciated quartzite carries ore in places.
		Hampton shale: Murray slate, Nebo quartzite, Nichols slate	Dark shale, slate, and quartzite.
		Unicoi formation: Cochran conglomerate, Hiwasee slate, Snowbird formation	Coarse arkosic sandstone, quartzite, conglomerate, slate, and a little limestone. Manganese carbonate ore associated with the limestone at one place.
	Pre-Cambrian	Granite and schist	Chiefly granite and schist.

(*a*) In western Virginia a thick series of Devonian rocks is present and the Oriskany formation, composed of sandstone, chert, and limestone, rests on limestone of Helderberg age, or unconformably on sandstone and limestone of Cayuga age. It carries manganese ore in places. (*b*) The so-called Tellico sandstone of Bradley County, Tenn., and adjacent part of Georgia is apparantly a thin bed of sandy ferruginous limestone at the base of the Sevier shale.

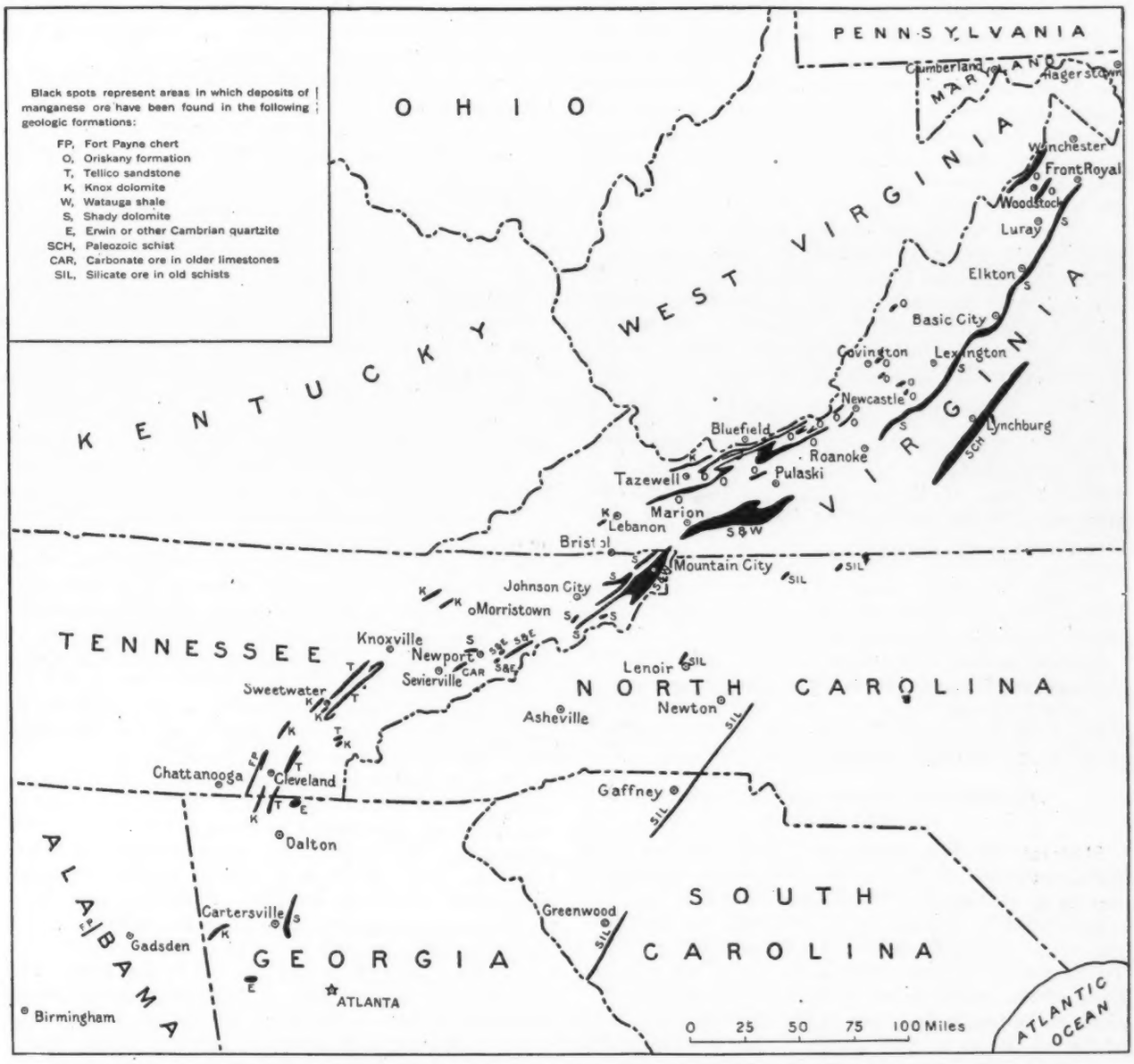
quartzite beds are broken into a coarse breccia by the intense folding and are healed by manganese oxide. The mineral is believed to have been derived from manganese-bearing beds near the base of the Shady dolomite.

Few deposits of this type are workable. At the Dry Run mine, near Compton, Va., seams up to three inches thick of psilomelane concentrically banded with manganite occupy a fractured zone about twenty feet wide. In east Tennessee, east of Newport, several mines were formerly operated in the quartzite.

Throughout the Appalachian Valley in Virginia, in parts of east Tennessee, and in northwest Georgia manganese ores occur in the clays that are residual from impure limestone beds near the base of the Shady dolomite, and these have been the most important source of manganese in the region. Deposits of this kind have been described in detail in several recent reports.[1]

The manganese ore is composed largely of separate small pieces of psilomelane, largely nodular in form, and some manganite and pyrolusite. Nearly all the ore in the Shady dolomite clay must be washed to free it from adhering sticky clay.

The manganese is believed to have been originally in a soluble form, probably the carbonate, in porous transition beds at the base of the formation, from which it was dissolved by meteoric waters and concentrated as oxide in adjacent, less pervious, residual clays which they have partly replaced. In most cases the ore accumulated on the bevelled edges of outcropping inclined beds of the Shady dolomite at the foot of the Erwin quartzite ridges, but where the rocks are gently folded at the surface the deposits are more highly concentrated at the bottoms of synclines. Manganese deposits



SKETCH MAP OF THE SOUTHERN APPALACHIAN REGION, SHOWING DISTRIBUTION OF AREAS IN WHICH MANGANESE DEPOSITS OCCUR IN CERTAIN GEOLOGIC FORMATIONS

[1]Hewett, D. F., *op. cit.*, pp. 37-71, 1916; Hewett, D. F., Stose, G. W., Katz, F. J., and Miser, H. D., "Possibilities for Manganese Ore on Certain Undeveloped Tracts in Shenandoah Valley, Va.," U. S. Geological Survey Bull. 660, pp. 271-296, 1918; the same authors, "The Manganese Deposits Along the West Foot of the Blue Ridge in Virginia," Geological Survey of Virginia, Bull. XVII, 1919; Stose, G. W., and Schrader, F. C., "Manganese Deposits of East Tennessee," Res. of Tenn., Vol. VIII, Nos. 3 and 4, 1918; Hull, J. P. D., La Forge, Lawrence, and Crane, W. R., "Manganese Deposits of Georgia," Geological Survey of Georgia, Bull. 55, 1919.

in the Shady dolomite clay occur at many places along the west foot of the Appalachian Mountains in Virginia, east Tennessee, and northwestern Georgia, where the Shady dolomite lies at the foot of the steep slope of the Erwin quartzite ridges and on both sides of limestone coves and re-entrant valleys within the mountains where the Shady has been infolded in minor plunging synclines.

The principal mine of the Shady dolomite type is the noted Crimora mine, Virginia. The ore here occurs in a minor southward plunging syncline between the mountain front and a low outlying quartzite spur in which the Shady dolomite is inclosed. The mine has produced over 200,000 tons of ore.

In the Cartersville district, Georgia, manganese deposits in the Shady are of large size, and over 100,000 tons of manganese ore have been mined. The manganese ore is here generally associated with iron ore and barite.

In northeastern Tennessee and in the adjoining part of Virginia workable deposits of manganese ore in Watauga shale have been prospected and mined. The ore is largely psilomelane, but in part dense compact wad, which occurs in pockets and seams in disintegrated yellow sandstone, which it has partly replaced, forming a breccia cemented by manganese oxide.

Deposits in Knox Dolomite

Chert in the Knox dolomite is in places impregnated with manganese oxide to such an extent as to form an ore, but none of the deposits have been profitably worked. Brittle chert layers have apparently been broken into small fragments by the rock folding, and in favorable situations have been cemented and partly replaced by manganese oxide. The chert and ore are set free by the weathering of the dolomite and are found in the residual soil on the slopes of chert hills.

Several prospects of this type have been opened in Tazewell and Bland counties, Va., and at many places in the valley of east Tennessee. Deposits near Rutledge, Tenn., and in Tazewell County, Va., which have been mined on a small scale, did not prove profitable.

Deposits in Tellico Sandstone and Holston Marble

Some of the best manganese ore in the region is found at the contact of the Tellico sandstone and Holston marble in southeastern Tennessee. The ore has been concentrated by solution of disseminated iron and manganese carbonates from red calcareous sandstone of the Tellico where it rests unconformably on the Holston. Some of the beds replaced by the ore preserve impressions of the fossils that were in the original rock. Most of the ore occurs in loose masses in the residual sandy clay which fills depressions in the surface of the unweathered marble. The ore is an intimate mixture of psilomelane and hausmannite, and averages over 50 per cent manganese. Productive mines are in the Sweetwater and Cleveland districts, southern Tennessee, and in the adjoining part of Georgia.

Deposits in Oriskany Sandstone

In the western part of Virginia workable deposits of manganese occur in the Oriskany sandstone. In Bland and Giles counties, where the Oriskany lies unconformably on sandstone of Cayuga age, large deposits of moderate-grade ore occur. The two principal properties are the Round Mountain and Flat Top mines, both of which are at the fractured crests of broad anticlines on the tops of high mountains. Deposits along the outcrop of the Oriskany sandstone have been prospected and mined northeastward to Allegheny and Bath counties, Va., but the ore is generally of medium grade and associated with iron ores.

In Shenandoah and Frederick counties, Va., deposits of high-grade ore occur and have been mined chiefly at Powells Fort mine, on Massanutten Mountain, where large quantities of pyrolusite used in dry batteries has been obtained. Here the purest ore replaces sandstone blocks in a breccia that fills a solution cavern.

Most of the ore in Oriskany sandstone is believed to have been derived from beds at the base of the sandstone that originally contained disseminated manganese associated with glauconite, phosphate nodules, and rounded quartz grains.

Deposits in Fort Payne Chert

The Fort Payne chert of Carboniferous age carries some high-grade manganese ore in the southeastern part of Tennessee and adjacent part of Alabama. The chert was apparently broken during folding and impregnated with manganese oxide derived from the weathering of interbedded limestone. The ore fills cracks and crevices in the cherts and replaces some of it, but the high-grade chemical ore is a soft powdery pyrolusite, containing 82 per cent MnO_2, in surficial clay and sand on an old peneplain surface. This high-grade ore is mined only around Walnut Grove, Ala., where the ore-bearing layer is two to three feet thick and lies between fifteen to twenty feet of barren surficial sandy clay.

Only a few mined deposits fall strictly into this class, although nearly all manganese deposits in residual clays of the Shady dolomite on the valley floor bench include in their upper part surficial clay and mountain wash, in which ore occurs. The only known manganese ores deposited primarily in stream gravel in this region are those at the Midvale and Kennedy mines, in Virginia, and at Silver Lake mine, northeast of Mountain City, Tenn.

Although many workable bodies of iron ore are known to occur along fault planes, only a few such deposits of manganese ore have been discovered in this region. One of these is at the Taylor Valley mine, northeast of Mountain City, Tenn., which is on a fault between pre-Cambrian schist and Shady dolomite. A fault breccia filling a zone about twenty feet wide is partly replaced by ore. The manganese-bearing solutions probably came from basal beds in the Shady dolomite cut by the fault. The only other manganese mine in the region known to be located on a fault is the Dargan mine, on the Potomac River, in Maryland, described by Hewett.[3] This deposit is also in a fault breccia adjacent to a limestone of the same age as the Shady dolomite.

Résumé of Southern Appalachian Deposits

Summing up the results of the study of the manganese oxide deposits in the southern Appalachians, the following conclusions have been reached:

1. Most of the oxide ores were derived from certain sedimentary layers which were originally richer in manganese than sediments in general, but which in no sense were concentrated deposits.

2. The original mineral was probably a carbonate of calcium, magnesium, iron, and possibly manganese.

[3]Hewett, D. F., *op. cit.*, pp. 69-71, 1916.

3. The beds that originally contained the disseminated manganese mineral occur at definite horizons, and several of these are associated with unconformities at the base of a sedimentary series or with marked changes in character of sediments, as those at the base of Shady dolomite, the Oriskany sandstone, and the Tellico sandstone. The manganese in these occurrences is believed to have been derived, with other unusual materials, such as glauconite, phosphate, iron, and rounded glassy quartz grains, from the disintegration of rocks on an old land surface.

4. The oxide ores were in nearly every instance concentrated by the solution of the disseminated manganese and its redeposition in the form of oxide in adjacent disintegrating rock or in overlying wash. In porous sandy layers, which afforded good channels for circulation, the sand grains were replaced by manganese oxide, and in impervious quartzites and clays the oxide was deposited on joints and in fractures and also more or less replaced the rock.

MAIN OPEN CUT FOLLOWING ORE BED, HAMBRIGHT MINE, SWEETWATER DISTRICT, TENN.

5. The purity of the ore is controlled largely by the purity of the rock replaced. The purest ore is formed by the replacement of a pure quartzite, chert, or limestone, whereas an argillaceous quartzite or limestone gives rise to argillaceous ore.

6. The concentration of ore into deposits took place most extensively on the surface of old peneplains where weathering had gone on for a long time and the rocks were deeply disintegrated. Meteoric waters containing the minerals dissolved from the weathering rocks migrated slowly downward through the disintegrated rock and met conditions which caused the precipitation of the ore near the base of the weathered zone.

Manganiferous carbonate ore occurs at several places in the partly metamorphosed sedimentary rocks of the Appalachian Mountains, but has been mined at only one place, near East Fork, Sevier County, Tenn. The ore occurs in lenticular layers in a zone three to ten feet wide along the contact of dolomite and slate of probable Cambrian age. The ore is in part a crystalline mineral composed of calcium, magnesium, and manganese carbonates crystallized in rhombic form, and in part a secondary enrichment of banded dark-brown uncrystalline manganiferous carbonate and thin intercallated laminæ of manganese oxide. The ore-bearing zone has been prospected for a length of about 4,000 ft., and has been opened up by a tunnel and a shaft 50 ft. deep. The ore is said to be self-fluxing.

MANGANESE SILICATE DEPOSITS

Many manganese-bearing silicate minerals occur in the rocks of this region, but seldom in sufficient quantity or concentration to constitute an ore of manganese. Manganese oxide deposits derived from silicate minerals, chiefly manganese-bearing garnet, in schist have been prospected at several places in the Piedmont Plateau of North Carolina and South Carolina, chiefly in a narrow northeast-southwest belt near Kings Mountain, N. C. and Blacksburg, S. C. None, however, appear to be of workable size. Veins of rhodonite of considerable size have been reported in the region, and were seriously considered as a source of manganese during the war, but the high cost of its reduction is prohibitive under normal conditions.

The manganese deposits of Arkansas lie in two districts, the Batesville and the West-Central. Those in the latter district are of little or no commercial value, and practically all of the production in the state has come from the Batesville[4] district.

High-grade manganese ore has been mined in the Batesville region since 1849, but mainly during two periods, 1885 to 1898 and 1915 to 1919. The total production of high-grade manganese ore from 1849 to 1918 inclusive was about 76,000 long tons, and in the same period about 70,000 long tons of ferruginous manganese ore was marketed. The manganese deposits lie in an east-west belt twenty miles long and four to

[4]Description is abstracted from a report by H. D. Miser, "Preliminary Report on the Deposits of Manganese Ore in the Batesville District," U. S. Geological Survey, Bull. 715, in manuscript.

eight miles wide, mainly in Independence County, but also in Sharp, Izard, and Stone counties, in the north-central part of the state.

The rocks of the Batesville district are all sedimentary, ranging from Ordovician to Carboniferous age, which dip gently southward, so that successively older rocks appear to the northward. The manganese ore is associated nearly everywhere with the uppermost Ordovician formation, the Cason shale, or the immediately subjacent Fernvale limestone. The shale is absent in many places, and the overlying St. Clair limestone, of Silurian age, or more generally the still higher Boone chert, of Carboniferous age, rests unconformably on the Fernvale limestone. The unconformable relations have an important bearing on the ore deposits, for manganese and phosphate were apparently partly concentrated in the residual materials on the old land surface represented by the plane of unconformity.

Although the deposits occur at all elevations, most of them are found on or near the tops of even-crested ridges which are remnants of an old peneplain. Most of the ore was probably concentrated in deeply disintegrated rock on this old peneplain when it formed the general surface of the land.

OPEN CUT OF McGUIRE MINE BEFORE TUNNEL WAS DRIVEN. SWEETWATER DISTRICT, TENN.

The deposits may be grouped into four types, depending partly on their mode of origin and partly on the rock formations with which they are associated, as follows:

Replacement deposits in Cason shale; replacement deposits in Fernvale limestone and residual deposits therefrom; replacement deposits in clay, and transported deposits in stream gravel.

The ore in the Cason shale is largely ferruginous manganese, composed of a mixture of psilomelane, braunite and red and brown iron oxides, which occurs as "buttons," layers, and irregular masses in the shale or its residual clay. The "buttons" are replacements of calcareous nodules of organic origin, and are so numerous in places that the shale which contains them forms a low-grade ore. Most of the buttons are composed of manganese oxide, but some are manganese-bearing carbonate. At the Cason mine, which has produced the largest quantity of low-grade ore in the district, the residual clay, and even some of the solid shale, with inclosed buttons, are mined and shipped without treatment, such ore averaging 20 per cent Mn and from 6 to 10 per cent Fe. The manganese is believed to have been derived from the manganese-bearing carbonate in the Cason shale by rock weathering, and then concentrated by redeposition as oxide.

Manganese oxides occur in irregular masses and lenticular bodies parallel to the bedding of the Fernvale limestone, especially in its upper part. The oxides are superficial and pass downward into manganese-bearing carbonate in the limestone. Manganese-bearing limestone has been mined at only a few places, most of the ore in this formation coming from concentrations as residual deposits.

Residual deposits derived from the weathering of the manganiferous Fernvale limestone have yielded the greater part of the high-grade manganese ore obtained in the Batesville area. The Southern mine alone has produced 36,500 tons of ore. The ore is chiefly psilomelane, hausmannite, and braunite inclosed in residual clay. This manganese-bearing clay fills deep solution depressions in the underlying formations.

Clay, derived from the weathering of any of the limestones or shales in the region, may be replaced by manganese oxide derived from the manganiferous Cason shale or Fernvale limestone. The replacement of the clay is generally not complete, resulting in a low-grade ferruginous ore. Only a few such deposits have been mined on a small scale.

Transported Deposits in Stream Gravel

Some hard masses of psilomelane and hausmannite set free by the decomposition of the Fernvale limestone and Cason shale have been transported by streams and deposited in stream gravel on terraces and in alluvial cones. The deposits are of small size, but contain high-grade ore.

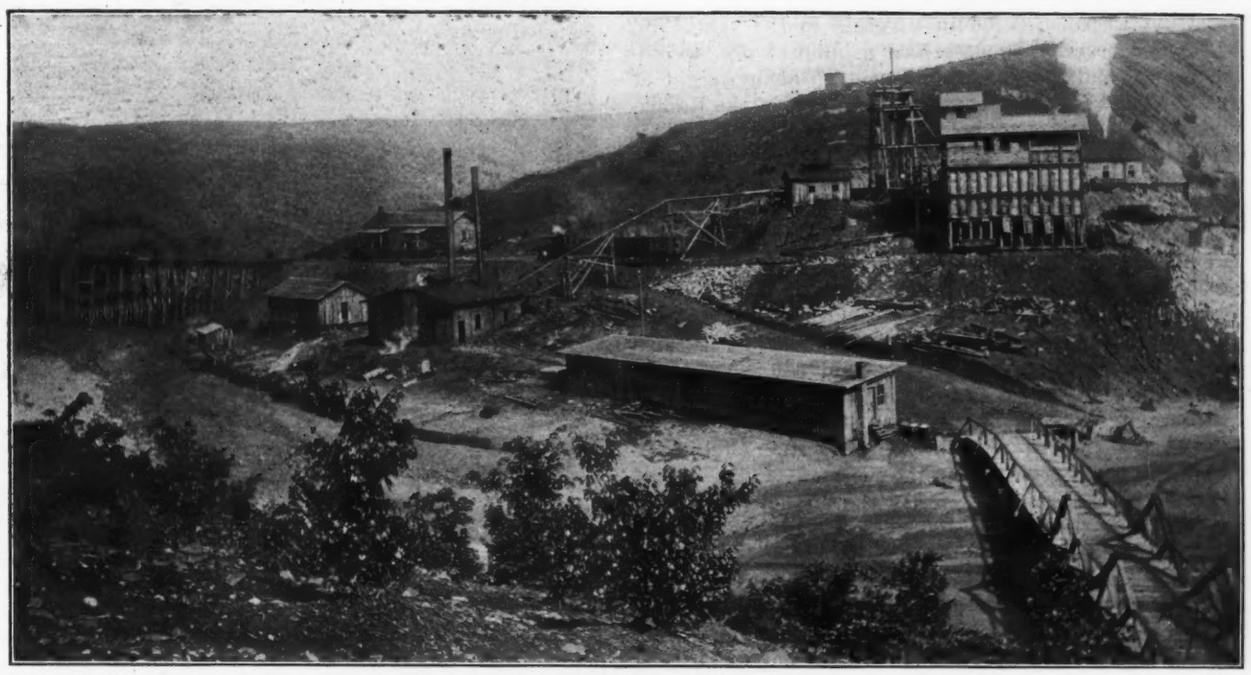
The deposits of the west-central district, which extends from Pulaski County, in the center of the state, westward to Polk County, at the west border, have been mined only on a small scale. Except for recent revival, the mining was done chiefly between 1885 and 1889. Recent work beginning in 1915 has been confined largely to the mountainous area in the western part of the district, and has been in part described by H. D. Miser.[5] from whose report the following is abstracted.

The mountainous area is part of the Ouachita Mountains. The rocks range from Cambrian to Carboniferous. The manganese deposits are all associated with the Arkansas novaculite, of Devonian and possibly in part Carboniferous age. Because of its hardness the novaculite forms the ridges, and numerous repetitions of these hard beds at the surface by tightly compressed folds have produced many nearly parallel east-trending straight ridges separated by narrow valleys.

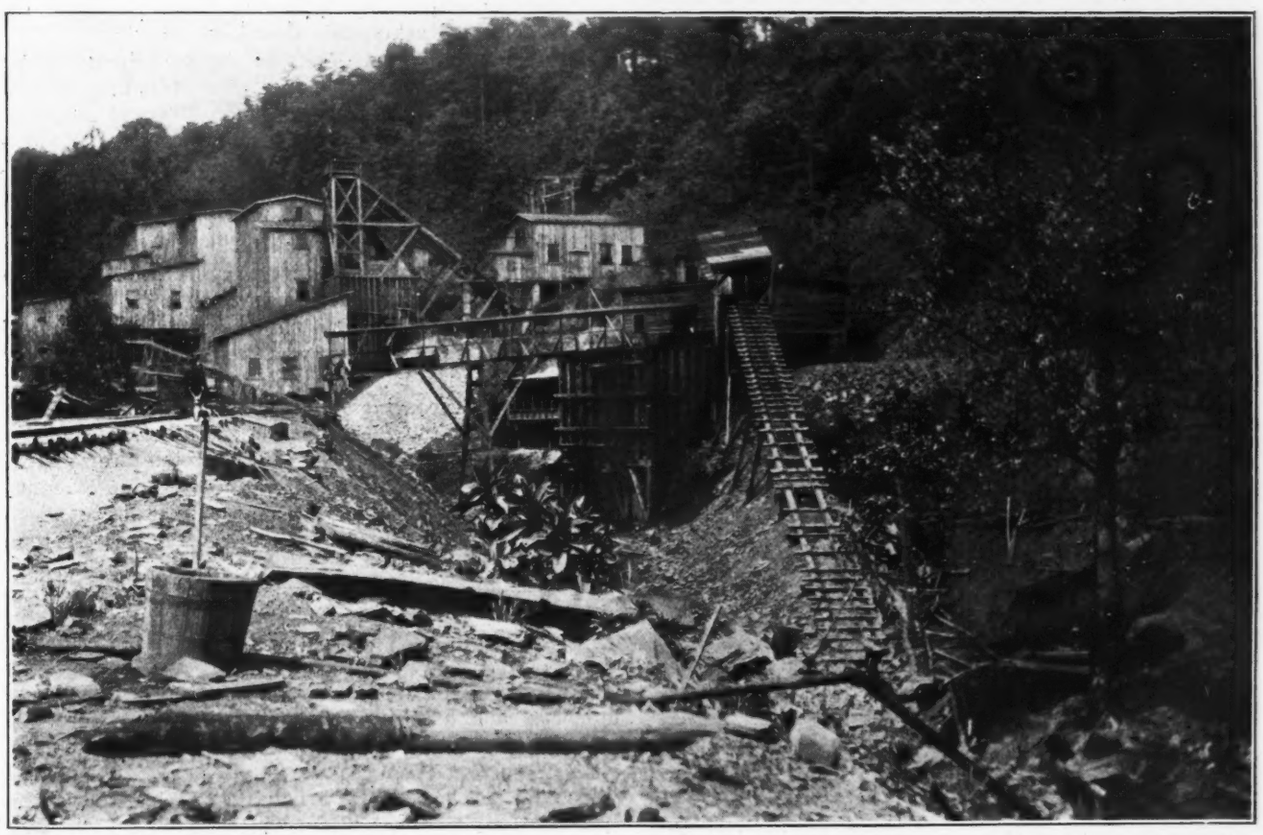
Manganese deposits occur chiefly at two horizons, near the base and near the top, so that the ore-bearing belts are repeated many times in the area. The manganese originally disseminated throughout the novaculite probably occurred in somewhat greater quantity at these two horizons and was dissolved as the rock weathered and was redeposited along joints and cracks, and in crevices of brecciated beds below. The ore is psilomelane, pyrolusite, manganite, and wad. Although the ore averages about 45 per cent manganese it is so scattered that no deposits have been worked with profit.

[5]Miser, H. D., "Manganese Deposits of the Caddo Gap and De Queen Quadrangles, Ark.," U. S. Geological Survey Bull. 660, pp. 59-112, 1918.

The Copper and Pyrites Industries in the South



SURFACE PLANT, SHAFT "A," COPPER PYRITES CORPORATION, DUCKTOWN BASIN, TENN. PHOTOGRAPH TAKEN DURING JUNE, 1919



PLANT OF CHESTATEE PYRITES AND CHEMICAL CORPORATION, CHESTATEE, GA. MINE ADIT AT RIGHT

The Virginia Gold Belt

Previous to the Civil War, Gold Production in the State Had Reached an Appreciable Figure for That Period—Geology of the District.

BY MARSHALL HANEY
Written for *Engineering and Mining Journal*

GOLD was discovered in Virginia in the year 1782. Thomas Jefferson described a lump of ore, weighing four pounds and yielding seventeen pennyweight of gold, which was taken from the north side of the Rappahannock River about four miles below the falls. This evidently was a piece of float, for Jefferson states that he heard of no other indication of gold in that section. The first deposit discovered was in the year of 1830 in Orange County.

The first gold-mining company in Virginia was incorporated on March 10, 1832, under the name of the Virginia Mining Co. and was backed by New York people. They purchased a one-half interest in a lease on a five-acre tract, for which they paid $30,000. About 1836 much prospecting and mining was being carried on in this belt. The production was steady from 1831 to 1850 and increased until 1860, when the Civil War stopped mining operations in the South.

During this period of activity the annual production ranged from $50,000 to $100,000 per year, which was considered a heavy production at that stage of gold mining. Immediately after the close of the war considerable activity was manifested in this section, several milling and reduction plants being erected at various points. Many of these attempts turned out to be failures, and in most instances they were abandoned.

The principal gold belt in the state begins in Montgomery County, Md., and crosses Virginia in a southwesterly direction to the North Carolina line. The belt varies in width from 20 to 30 miles and is 200 miles long. The area covered is about 4,000 square miles, with the best developed portion in Fauquier, Stafford, Culpeper, Orange, Spottsylvania, Louisa, Fluvanna, Goochland and Buckingham Counties.

OPEN-CUT PROSPECT TRENCH, SHOWING WIDTH OF VEIN

PART OF A MILL BUILT ONE STORY OF STONE

Micaceous schists and gneisses are the principal rocks of the belt, which also includes altered sediments and igneous masses. The strike is north 20 to 30 deg. east and the dip is toward the east and southeast at varying angles, generally very steep and in places practically vertical. Masses of granite and dikes of basic igneous rocks frequently occur in the region.

The gold-bearing veins are quartz and vary from large crystalline masses to very fine grains. The principal metallic content is auriferous pyrite.

Early mining was confined to the oxidized portions of the veins, in which the ore was free milling, and below the ground-water level the gold occurs as sulphurets. The quartz gold-bearing veins, which vary in width from a few inches to ten feet, conform to the strike and dip of the inclosing rock. Some of the veins are remarkable for their persistence and continuity; for example, the Fisher vein, in Louisa County, has been opened along its strike for a distance of five miles and to a depth of 250 ft.

Mining in Georgia

The largest producers of barytes in Georgia are Thompson, Weinman & Co. They are both miners and finishers, and are situated at Cartersville, where are also established W. C. Satterfield and W. S. Peebles, other important producers.

The largest producer of bauxite in Georgia is the General Bauxite Corporation, which has a large quarry at Toomsboro.

Gold in McDuffie County, Ga.

Old District First Opened Early in the Nineteenth Century Now Making Irregular Production—Local Interest Dormant

BY PAUL T. BRUHL

Written for *Engineering and Mining Journal*

ALMOST a century ago attention was directed to the possibilities of McDuffie County, Ga., as a gold producer, by the presence of rich pieces of float. Even now, after the cream has been skimmed, the practised eye is afforded an occasional opportunity to select a piece of float that would revive in the most disillusioned prospector his early belief in the existence of bonanzas. One rich specimen, however, does not make a gold mine. Conversely, a rich specimen need not occasion an acute fit of depression. Float lies in a belt about two miles wide, and can be seen scattered over the cotton fields and patches of corn. It consists of lumps of quartz, as big as a man's fist on an average, stained brown and traversed by cracks.

Mining in McDuffie County has had many vicissitudes. It has been affected by the lack of experienced labor, by undue optimism accompanied by a lean purse, by the failure to "come back" after temporary depression, and by the fact that the "native" looks with more favor on cotton crops, which represent tangible wealth, than he does on a mine, which he regards with suspicion because he does not understand it. Local capital can be so profitably invested in farming that the lure of gold mining is not strong. Hence, the industry, lacking local support, is at a disadvantage[1].

The Georgia gold output has totaled approximately $18,000,000. Auriferous veins at or near the surface proved profitable, but successive operators, finding that the oxidized zone did not extend indefinitely, became discouraged. No systematic work has been attempted, and, as each lessee has endeavored to pick out the highest-grade deposit, the average value of the ore has diminished. Continuous development would have given better results. Milling practice has passed successively through amalgamation and the amalgamation plus concentration stages, until a counter-current decantation flow sheet now represents the point to which local metallurgy has progressed.

Of the mines in McDuffie County, the most productive have been the Columbia and the Parks. The former was a small but profitable venture, worked as long ago as 1833, and is reputed to have yielded $1,500,000 from the oxidized portions of the veins. The topography about the mine is one of gently rolling hills, the average elevation being about 500 ft. The rainfall averages thirty inches. The roads are in fair condition, though in the wet months they become (at times) impassable for trucks. Hence a fuel supply sufficient for several weeks is necessary. It has been estimated that water power equivalent to 300 hp. could be developed from Little River by means of a dam 15 ft. high.

The ore is auriferous quartz occurring in a succession of pinches and swells, with an occasional layer of gouge between the vein and walls. About half of the gold is free-milling, the remainder being associated with iron pyrites, galena, and, here and there, with chalcopyrite. Some pyromorphite has been found in the zone of oxidation, which extends to a depth of 100 ft. from the surface and is 50 ft. below ground-water level.

The galena is rich in gold, though its value varies within wide limits in different portions of the same vein. The pyrite is much poorer in gold. Associated with each ounce of gold is approximately one-fifth of an ounce of silver. The vein walls are well defined, and the gold contents are scattered somewhat irregularly along the line of strike. In the oxidized portions, the country rock contains a little gold, the foot wall being usually appreciably richer than the hanging wall. Panning adjacent rock yields a small amount of sulphides, with an occasional speck of free gold.

The McDuffie belt forms part of the South Appalachian gold district, which extends northeasterly and southwesterly. The veins occur in Pre-Cambrian formations, which have been subjected to considerable shearing stresses, as is evidenced by the structure of the gneisses and sericitic mica-schists of which the country rock is largely composed. It is considered probable that the vein material was derived from hot solutions rising from great depths and that most of the gold was deposited, according to G. F. Becker, "at the close of the great volcanic era or during the Algonkian."

Bearing in mind the enormous erosion to which the formations have been subjected, it is assumed that the veins, when originally formed, must have extended to considerable depth. Secondary enrichment is inconspicuous. The McDuffie deposits are only a short distance north of the line separating the crystalline belt of rocks from the Cretaceous and Tertiary rocks on the south. They extend through the northern part of the county and are most valuable in the vicinity of Little River, about twelve miles north of Thomson.

In the opinion of S. P. Jones, the country rocks "show evidence of having been derived from rather basic porphyritic granites or from granodiorites." He is of the opinion that part of the gold was derived from granite magmas and that a specially rich deposit was favorably influenced by a contact zone "where basic rocks at present containing large amounts of hornblende, were associated with more acid rocks."

[1]NOTE—To give all sides to the question we quote from a letter recently received from a mining engineer:

"One of the old niggers came to me after we had shut down, and said, 'Say, boss, we niggers has seen mining here fo' a long time, and when the stamp mill starts the mine shuts down.' This is true in McDuffie County, Ga. A great many mines have started up here and then shut down. If you ever hear of any one trying to invest money here, warn them. There are as many abandoned mines and mills around here as in a boom camp after the boom is over."—EDITOR.

Bauxite in the South

The bauxite industry is one of the principal of mining industries in the Southern states, the principal sources of supply being central Arkansas, northwestern and central Georgia, northeastern Alabama, and southeastern Tennessee. From these fields there was produced in 1917 a total of 568,690 long tons of ore.

The principal use of bauxite is in the manufacture of metallic aluminum. It is also used to a large extent in the manufacture of a refractory brick for surface linings, as well as in the manufacture of artificial abrasives. In 1917 nearly 65 per cent of the domestic output of bauxite went into aluminum; 13 per cent into the manufacture of alumina salts, such as alum, for use in water purification, dyeing, and tanning; 19 per cent was consumed in the manufacture of abrasives; and 3 per cent in the manufacture of refractories.

The bauxite deposits of the United States have resulted from the alteration of kaolin, which is residual from the weathering of rocks.

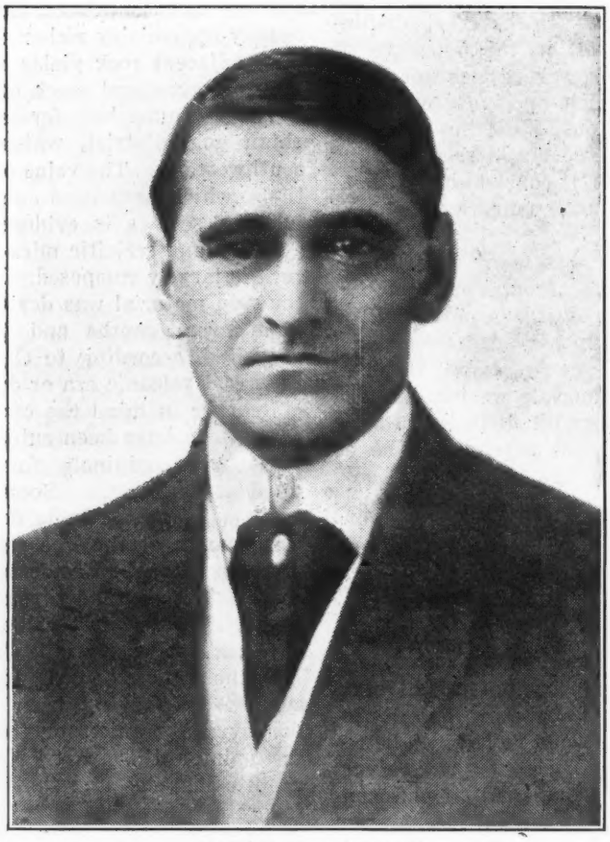
Prominent Mining Geologists

Joseph Hyde Pratt

THE Engineer Corps of the Army, during the Great War, performed so brilliantly that its record is bound to stand out notably in the pages of American military history. The work of the engineers took them into the most dangerous areas, and in case of attack they were often called upon to handle a gun on the same footing as the infantry. But little time was allowed for training, or, rather, it was allowed, but was rarely obtained. Colonel J. H. Pratt, commanding officer of the 105th Engineering Regiment, was allowed just eight days in France before word came that the British forces in Flanders needed help. Three days of marching took the regiment to Terdeghem, where, under shellfire, the men went to work tangling up barbed wire to the best of their ability. This was in August, 1918. On the last day of that month the first advance in the Canal sector, since the big push of the Germans, was made by the Thirtieth Division, of which Colonel Pratt had been made Division Engineer. This was the beginning of the end for the Germans. More important work, however, soon developed elsewhere. On Sept. 5, the 105th Engineers, together with other units of the Thirtieth Division, started for France, and on Sept. 24 became a part of the Second American Corps attached to the Fourth British Army in front of the Hindenburg line between St. Quentin and Cambrai. Five days later Colonel Pratt's engineers were in the thick of the fight which resulted in the capture of Bellicourt and Nauroy. Later, in the battle of the Selle River, they were called on to build three bridges, which is not the pleasantest job in the world with the business end of several thousand guns pointed your way. Each time the division was withdrawn from the front line for rest and reorganization the Engineers were kept in the forward areas building roads and railways.

At the time, Colonel Pratt wrote: "I had several narrow escapes and never did get used to the shelling. I would shy a good deal, but I was always able to make my legs take me where I wanted to go." He doesn't say which way that was, but those who know him can make an intelligent guess, and the general direction wasn't west.

Colonel Pratt is just the kind of a man most any one would have picked for the difficult work in France, for he already had the habit of doing things on this side.



JOSEPH HYDE PRATT

Born fifty years ago, his life has been a full one. After being graduated from Yale, he was instructor in mineralogy there for two years, after which he went to North Carolina. There he has been prominently identified with most of the mineralogical and geological activities of the state. After being mineralogist of North Carolina for nine years, he was made State Geologist, and since 1904 has been professor of economic geology at the University of North Carolina. His exhibit of North Carolina gems and gem minerals will be remembered by many who attended the Pan American and Charleston exhibitions. Like some other engineers whom we might mention, Colonel Pratt's activities have not been confined to his profession. He has been greatly interested in good roads, in swamp drainage, and in the conservation of the forests and water powers of his state. He is responsible for the creation of the State Highway Commission and prison reform legislation. He was even president of the National Association of Shell Fish Commissioners!

Colonel Pratt belongs to a Congregational church of New Haven, Conn., and the Episcopal church of Chapel Hill, N. C. What stronger evidence could be adduced that he is catholic in his tastes? The list of societies and clubs to which he belongs is a long one. Included are the A. I. M. E., the Mining and Metallurgical Society of America, the Yale Club of New York City, the Cosmos Club of Washington, D. C., the Capitol Club of Raleigh, N. C., the A. T. O. fraternity, and the Sigma Xi.

Joseph H. Pratt is not a southerner by birth but by adoption. The southern spirit was no doubt bequeathed to him by his father, who was captain of a Louisiana regiment in the Civil War. Perhaps this is where he acquired those qualities that have distinguished his most creditable military career.

By The Way

The One Thing Needful

All's well that ends well. The Tonoph-Divide mine has the complete endorsement of George Graham Rice, according to a Tonopah paper. Mr. Rice recently visited the property, after an absence of fully ten years from southern Nevada, and is quoted as saying:

If one thing was more apparent to me than another, after going through thousands of feet of underground workings, it was that one of the biggest and most promising silver mines in the whole state has been "black-jacked" and besmirched as no other great property ever was before.

My impression from the reports I read prior to entering the property was that the mine had been bottomed at the 585-ft. level, and yet, on the 585-ft. level, I was shown 15 ft. of ore extending for 75 ft. on the strike of the vein that the company officials say averages better than 30 oz. of silver per ton; *and assuredly I did not need the word of anybody that it was rich silver ore, because it had the aspect of a strong silver orebody which could not possibly be mistaken.* I had some of the rock assayed, and the returns I obtained were better than 100 oz. to the ton. . .

It is quite true that on this level there are lean spots, and that for a considerable distance in the drift the values are low, but the significance can hardly be that the orebody has pinched out at the 585-ft. level. *It is certainly a truism that every bonanza mine has its lean spots, and it follows very logically that the bigger the mine the bigger the lean spots will be wherever they are encountered.*

It follows with equal logic that the biggest mine of all will be the one where the ore is entirely lean. Doubtless, a proposition even more attractive to Mr. Rice would be a mine where there was no ore at all.

On Raising Chickens

It is not often that an engineer goes outside his chosen profession to seek renown in poultry raising. H. F. Wierum, general manager of the American Mineral Production Co., one of the large magnesite companies of Washington, has started the farmers of eastern Washington guessing. He tried an experiment of feeding his hens ground magnesite instead of lime, and is now out with the claim that the resultant egg shell has far superior insulating and wearing qualities than does the common variety.

But who wants an insulated egg? we ask Mr. Wierum. We would rather have them fresh, and, next to this, less fragile. Mr. Wierum should try feeding his hens a little cement along with the sand and gravel that they normally swallow and see if he cannot produce an egg with a concrete shell. This would stand shipment anywhere without crates, and thus lower the price by a fraction to the consumer. Some experimenting would, of course, be necessary, as cement ordinarily will give a chicken hardening of the arteries or the like. But engineers have overcome greater obstacles than this.

Surface Tension

An English correspondent sends us the following abstract from a paper presented before the Academy of Sciences, Paris:

The authors have found that anæsthetics and analgesics possess the well-marked property of diminishing the surface tension of serum. On the other hand, it has been proved that all the substances used for the prevention of anaphylactic phenomena, such as lecithin, the alkalis, and soaps, also have the property of lowering the surface tension. Experiments are given on the suppression of anaphylactic shock by anæsthetics. The results obtained confirm the view that it is not the nervous system which is mainly affected by the anaphylactic shock, but a reaction of colloidal flocculation leading to asphyxia from the obstruction of the capillary networks.

We don't understand the exact meaning of all this, in our medical ignorance, but it would seem that anyone thinking of having a leg off had better take out a license from Minerals Separation to be on the safe side, or on as safe a side as possible.

Vulture's Exit

The original camp of Vulture, Ariz., disappeared long ago under remarkable circumstances. W. A. Farish had a lease on the old bonanza. This lease was abandoned as the ledge matter proved too lean for profit, but not until Farish had run through the mill the walls of the camp cabins. They had been built of rock from the mine outcrops.

Geologists We Do Not Recommend; L. H. Colyer Submits a "Geilogical Report"

The report of another Texas representative of the tribe of Metalliferous Murphy has been sent to us. It states:

The general typography and glossary of horizon stone will be taken up first. Character of stone in this district is of sand, the greater portion being of the sand carbonate family, however much carbonate carboniferous standstone is exposed. I note limestone magnesia on surface and deep lental exposures. Sandstone folds in this zone are in perfect place.

So far, all correct. It is a relief at least to know that the character of the stone is what it ought to be and that it comes of good family. Later it appears that the stone is of Permian age; moreover:

The cretitious action and disintegrated matter that exist here shows every necessary element to land petroleum oil may be expected at this point. There being much carbon in all stone and likewise sulphur, and carbonate of sodas are contained in substances. Saline products are also much in evidence.

Apparently, there is a little too much soda-water in this ancient stone, of good character and family.

We feel confident that when this great eruption that caused this wonderful fold to be placed in the position that it now lies, there existed a great southern drift of decomposed matter which was carried from the surface of this structure by the Devonian waters and left bare the form of this beautiful body in such a way that one cannot be misled as to the exact and correct contours as they exist.

Oh fie now, Mr. Geologist. What do you call character anyway? And to make matters worse you report:

A large pool of water just below the riffle, which is very deep, and while our party was exploring this place we noted the water kept a continuous blubbering in many places in this pool, and upon inquiry from Mr. ——— —— and others, we were informed that this blubbering was continuous and had been noticed ever since the settling of the country.

Was this a nice thing for your respectable stone to do to the water? It is all very perplexing to be sure, but now come the fireworks:

Small lental spherical bodies, surface gashes, that have been caused by the many ages of waterfall, all show a correct affinity, and a great nucleus of evidence that petroleum oil and a natural gas exist in this zone.

We shall not proceed. We are not quite sure that this is just what our readers should have. The *Engineering and Mining Journal* goes into the most refined homes.

CONSULTATION

Dollar Silver Perplexities

"In recent issues of the *Engineering and Mining Journal*, New York quotations for silver have been given separately for silver of domestic origin and for silver of foreign origin and a statement has been appended to the effect that 'on the authority of the Secretary of the Treasury we quote 100c. per oz. for silver, 1,000 fine, etc.' Smelters have been making settlement on the basis of a quotation of 99⅝c. per oz. and we presume that the deduction of ⅜c. is to give the equivalent price for silver 999 fine instead of 1,000 fine. Is this correct?

"The appended statement also recites that the quotation is retroactive on silver of domestic origin to May 13. On page 1292 of the *Engineering and Mining Journal* the average price of silver for the month of May is given as 102.585c. per oz. Will you please advise me whether this average is for silver of domestic origin, and whether in making settlement for domestic ores shipped to the smelter to be paid for on the basis of the average monthly quotation for May, such settlement should be based upon a price of 102.585c. or upon some other figure? I presume that since the lowest quotation for silver during the month of May was 99⅝c. there would be no change in the average for this month.

"On pages 43 and 46 of the *Engineering and Mining Journal* for July 3, the monthly average price of silver is stated to be 90.957c. per oz. Inasmuch as many smelter settlements are being based upon the average monthly price of silver as quoted by the *Engineering and Mining Journal*, and in order to prevent disputes over technicalities, I would suggest that your journal should quote the monthly average prices for silver of domestic origin, independently of the price for silver of foreign origin. Such averages can be obtained by taking the arithmetical average of the daily quotations, which I believe would show 99½c. for the month of June, but nevertheless in order to make this important matter clear I would suggest that you should define these prices with exactitude, and upon the usual basis of silver, 999 fine."

Under the Pittman Act, the United States Government is now purchasing all silver offered, at $1 per oz., 1,000 fine, provided it can be proved to have been mined, smelted and refined in this country. This is equivalent to 99.9c. per oz., 999 fine, which is the purity heretofore quoted in the *Engineering and Mining Journal*. Delivery charges must be paid by the refiner, so that in making settlement, something must be allowed for them. Handy & Harman, who do a large part of the silver marketing in this country, about noon of each day decide on an official price based upon actual sales or bid and asked quotations during the morning. They have agreed that 0.4c. per oz. is a fair price for delivery to the mint, and have, therefore, established 99.9 minus 0.4, or 99.5c., as a fair price for domestic silver in New York, 999 fine.

Some American smelters have decided to make settlements on the basis of 99⅜c. per oz., thus allowing only 0.275c. per oz. for delivery charges. They may be so situated that this figure is a fairer one. However, as already explained, the 99½c. figure is the one quoted by Handy & Harman, whose price has generally been accepted as official.

The price of silver in New York did not drop below 99½c. until June 3, so that our average of 102,585c. as given for May is correct for either domestic or foreign silver. Our June average, 90.957c., of course represents foreign silver, the average price of domestic silver for that month being 99½c. To avoid confusion we shall quote the average monthly price of domestic silver hereafter, in addition to that for the foreign article, even though the former remains constant at 99½c., as is altogether likely as long as the Pittman Act is in force.

Oil Shale Machinery

"Our office is desirous of obtaining prices and full particulars of an apparatus for extracting oil from shale in large quantities. They state the shale contains about 10 per cent oil.

"Will you be good enough to advise us of the names of manufacturers of this equipment."

We do not know of any company manufacturing retorts for the distillation of oil shale in this country. The industry is so embryonic that there is considerable doubt as to whether any attempt has been made to manufacture this sort of machinery in the United States. Much experimentation has been made upon the distillation of oil shales, and processes devised which investigators have assiduously acclaimed as being eminently practicable for the purpose, but no demonstration, so far as we know, has been made upon a large enough commercial scale.

Estimates of the cost of a 1,000-ton retorting plant vary widely from $300,000 to $2,500,000 and up. The higher estimates include machinery for recovering by-products such as sulphuric acid and ammonium sulphate from the distillation. Last year a 1,200-ton plant in Colorado of the regulation continuous vertical type was figured at $1,200 per ton.

It is our impression that until the oil shale industry has become a commercial success in the United States and further large scale experimentation performed, no regular manufacturers of the distillation machinery will be available in the United States, and any apparatus ordered will be made from special designs.

No United States Cryolite Production

"Is any appreciable amount of cryolite produced in the United States?"

Cryolite, the double salt of sodium fluoride and aluminum fluoride ($3\ NaF.\ Al\ F_3$) is not commercially produced in the United States. It has been reported as a mineral discovered in certain parts of the United States, notably near Pike's Peak, Col., but not in sufficient quantities to warrant profitable exploitation. All of the cryolite used in this country comes from Greenland, and in 1917, 4,383 tons of this material were imported, the greatest amount since 1898. In 1918 imports dropped to 1,950 tons, having a value of $50 per ton. There is no import duty on cryolite.

THE PETROLEUM INDUSTRY

Graphic Representation of Oil-Well Decline

Use of Curves To Express Increased or Decreased Production From Oil Wells—More Consideration Should Be Given to Production Records of Individual Wells and an Attempt Made To Obtain an Estimate of Total Recoverable Oil

BY S. S. LANGLEY
Written for *Engineering and Mining Journal*

GRAPHIC representation of the production of an oil property by periods, daily, monthly or yearly, will show only whether the production has increased or decreased. Fig. 1 is such a curve, computed from actual records, and an analysis of this curve will draw attention to the addition of thirty-three wells and eight hundred barrels' daily production on Oct. 1, 1919. On Sept. 30, 422 wells produced 10,500 bbl., and the influence of the new wells is seen in the production curve until Oct. 10, when it is apparent that the daily production decreased to a point little, if any, higher than it was during September. These are significant facts and raise the question as to their cause. The curve does not present a solution. The relation between the new and old wells could be shown by a graphic presentation of a per-well per-day production, but this would add nothing to the information as to why production decreased so rapidly after Oct. 10.

There is evidence that the decrease has been rapid, and the first impression is that the rate of decline has been abnormal. The production shown in Fig. 1 is a total of many leases in several fields, and a study of the production of each lease will disclose the source of the decline. It is then necessary to learn the cause, and this cannot be determined accurately until it is known whether or not the decline is normal.

Wells in different fields may not and probably will not follow similar rates of decline. This is also true of wells in different parts of the same field, and even of adjacent wells, but those in the same field of like initial production will have similar rates of decline. To determine the normal rate of decline, it is therefore necessary to divide the wells of each lease into groups of like initial production. A curve can then be computed for each group, and the comparison of any well with its group will show whether or not that well has followed a normal rate of decline.

TYPES OF CURVES

Fig. 2 is a comparison of "Production Decline Curve" (*A*) and "Per Cent Production Decline Curve" (*B*) for a group of wells whose initial production was between 3,000 and 3,500 bbl. per month. *"A"* represents the average production per month of this group, and *"B"* indicates the percentage of production for any month, up to the 20th, with respect to the maximum production. Each curve serves a distinct purpose. *"A"* can be used to forecast the production per month of a new well of this group, and *"B"* will serve as a means of comparison between per cent rates of the decline of different groups. The following is an example of the use of *"B"*:

During a unit period, the total production of a group falls from 11,000 bbl. per day to 9,250 bbl., indicating a decline of 15.9 per cent, while during the same unit period another group declines from 1,000 bbl. to 750 bbl., or a decrease of 25 per cent. Such figures would cause one to examine the smaller group, as the lower the initial production the slower the per cent of decline anticipated. If desired, the per cent rate of decline of all the groups can be merged into a total property per cent decline curve, but to do so is of little or no value as an indicator of the cause of decline. It can lead to the failure to notice important changes. Had the figures of the previous examples been presented only as a combined per cent decline for the two groups, it would have appeared that 17.1 per cent was the average of the two groups, and there would have been nothing to indicate that the smaller had declined 25 per cent.

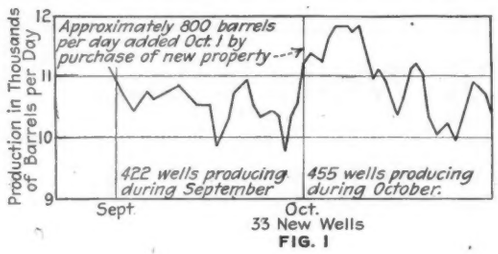
METHOD OF COMPUTING CURVES

Fig. 3 shows two curves of the same group. *"A"* was made up by introducing the wells of the group in the months in which they were completed. *"B"* represents all wells of this group as completed in the same month, with the result that each month is a true representation of the group decline. *"A"* shows an increase in production during the second month because there was but one well of this group producing, and it did not reach its maximum production until the second month. It is impossible to know from *"A"* what causes an increase of production, whereas it is known that any increase in *"B"* is due to an actual greater average production of the group. The method of computing *"B"* may appear objectionable, as the curve must be re-calculated each time another well of its group is completed. The accuracy of any curve depends upon the number of units making up its average, and the value depends upon the accuracy.

In Fig. 4 and Fig. 5 are presented the per cent decline curves of all groups of a lease. Those wells which would reach a maximum of between 4,000 and 3,500 bbl. per month were placed in the 3,500 group, and, following this method of division, all of the wells of the property were assigned to their respective groups. The average monthly production was then separated into successive periods of four months each, and an average found for the four months of each period. This average was referred to the maximum monthly average, to compute the per cent of production.

The comparative per cent decline of the groups is, perhaps, shown more clearly by Table I, in which the amounts of the per cent decline below 100 are shown

rather than the per cent of 100. This table presents some unexpected facts. At the end of the first four months only the 500 group had declined less than the 3,500 group. At the close of the second period, the condition is more nearly what would be expected, although the 500 group. At the close of the fifth period, the groups approached the relative positions expected; that is, the groups of greatest initial production show the greatest per cent decline. The 500 group cannot be taken as a fair indicator after the sixteenth month, as


Production in Thousands of Barrels per Day
Approximately 800 barrels per day added Oct. 1 by purchase of new property
422 wells producing during September
455 wells producing during October.
Sept.
Oct.
33 New Wells
FIG. 1

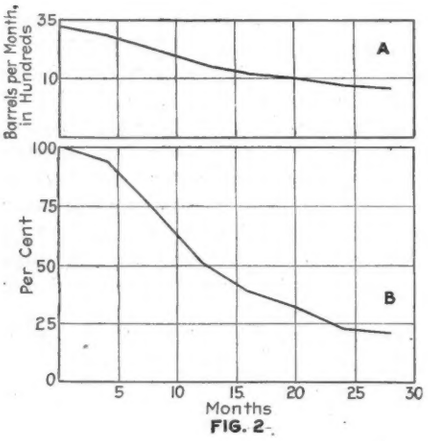


FIG. 2

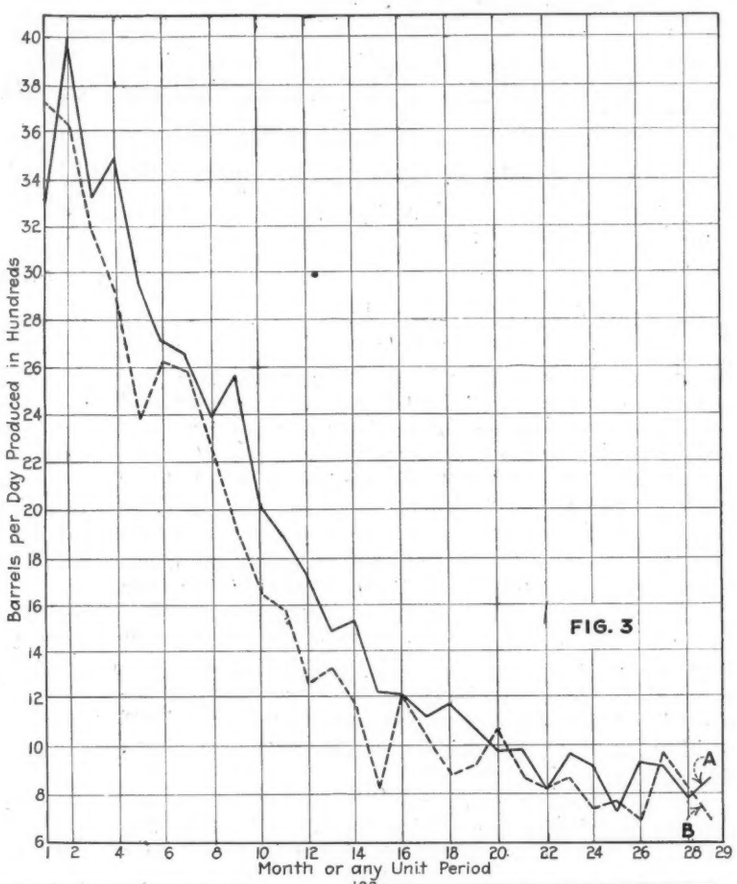


FIG. 3

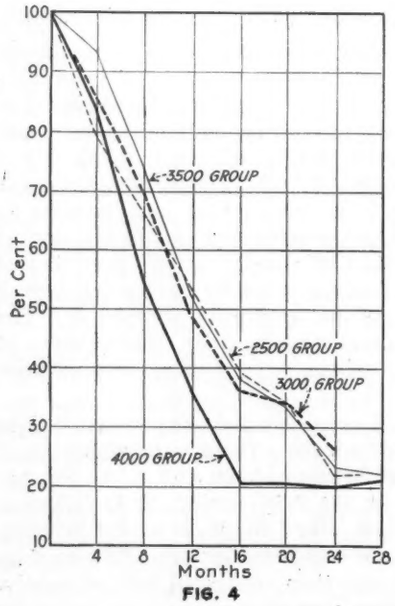


FIG. 4

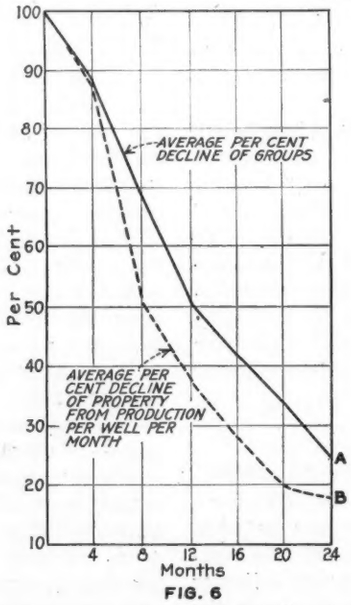


FIG. 6

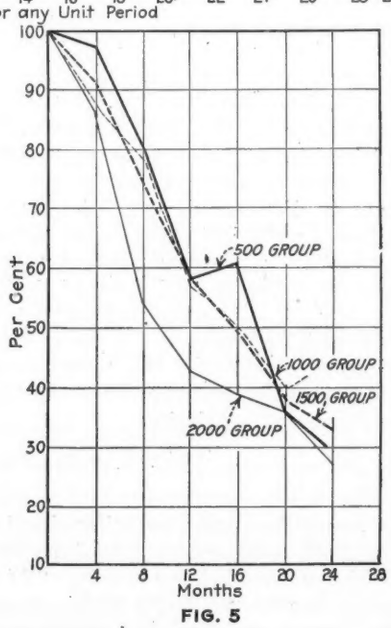


FIG. 5

CURVES SHOWING INCREASE AND DECLINE IN OIL-WELL PRODUCTION

the 2,000 group shows a greater per cent decline than any other. At the end of the third period, the 4,000, 3,000 and 2,000 groups had declined more than one-half of their maximum production, and by the end of the fourth period (sixteenth month) this is true of all but there was only one well producing after that period. Attention is drawn to the fact that the four larger groups require only two years in which to decline 75 per cent of their maximum production as indicated by the curves in Fig. 5.

In Fig. 6 is shown a comparison between the average per cent decline of the groups *"A"* and an average per cent decline of the production per well per month *"B."* *"A"* is a curve made up from the averages of the groups, as shown in Table I, and *"B"* is computed from the monthly production of the property. The comparison serves to show the error encountered in a curve such as "B." Due to the fact that wells of low initial production are completed and brought into the average while those of greater production are still in their early months, the average per well per month is low, although the total production has increased. As a further illustration of the inaccuracy of *"B,"* suppose a well of the 3,500 group is abandoned at the end of its eighth month of production. The per cent decline as shown by the curve of the 3,500 group (Table I) is twenty-six, whereas the per cent decline as represented by *"B"* Fig. 6, is forty-nine.

TABLE I. COMPARATIVE PER CENT DECLINE OF OIL WELLS

End of Group	4th Mo.	8th Mo.	12th Mo.	16th Mo.	20th Mo.	24th Mo.	
4,000	16	45	64	79	79	80	
3,500	7	26	48	62	67	77	
3,000	14	30	51	64	66	74	
2,500	21	34	47	61	66	76.6	
2,000	14	46	57	61	64	73	
1,500	9	26	42	51	62	67	
1,000	13	22	43	50	60		
500	3	20	42	39	64		
	12	31	49	58	66	75	Average group per cent decline
	13	49	62	72	80	82	Average per well per month per cent decline

A great many of the large operators do not give sufficient consideration to the production records of the individual wells. It seems to be considered that the total production of the company, or, at most, the total production of individual leases, is all that is necessary. As each well is of importance in accordance with its possible maximum production, and the investment represented by it, corresponding attention is warranted. An investment of $50,000 on the payroll would most certainly be watched.

The per cent decline, or the production decline, represents depreciation of resources, just as production of ore represents depreciation of reserves.

Although it is not possible to predict with absolute accuracy the total recoverable oil, this is not sufficient reason for making no attempt to reach as trustworthy an estimate as possible.

The Osage-Newcastle Oil Field Of Wyoming*

OWING to the comparatively recent discovery of oil in commercial quantities near Osage, Wyo., many inquiries have been made of the State Geologist's office in regard to the oil possibilities of the area, and this article is issued for the purpose of giving a general idea of the conditions existing in the Osage-Newcastle region and is not the result of a detailed and comprehensive survey.

The Osage-Newcastle area lies southwest of the C. B. & Q. Ry., between Osage and Newcastle, and practically parallels the railroad. Prospecting and development are also extending to the northwest of Osage as far as Upton and Thornton and the southeast of Newcastle as far as Ardmore, S. D.

Structurally this district is a portion of the southwesterly dipping monocline which lies on the southwestern flank of the Black Hills uplift, which in itself is a huge, elongated dome containing a core of granite and metamorphic rocks and representing a vertical displacement of about 9,000 ft. The normal dip of the monocline is 4 or 5 deg., but in a number of places the dip is greatly increased, as, for instance, from two to four miles west of Newcastle, where it ranges from 50 to 60 deg. Also to the southeast of Newcastle very steep dips have been recorded.

It was noted that an outcrop of Greenhorn limestone marked a zone of steeply dipping rocks south and southeast of Osage and that the strata flattened both to the northeast and southwest of this zone. This change in dip, or terracing, probably is one of the controlling influences in the accumulation of oil, especially in the Osage portion of the area. Other structural changes were also noted, such as slight folding, especially northwest of Osage, and there is also the probability of considerable faulting in a zone of almost vertical outcrops near Newcastle.

Oil-Bearing Sands in Lower Benton Formation

The commercially oil-bearing sands in the district are confined, as far as is known, to the Graneros, or lower Benton, formation. The principal sand is from 25 to 40 ft. thick and lies near the base of the Granderos. Above this sand there are about 110 ft. of sandy shales overlain by another but much thinner oil-bearing sand. The lower sandstone outcrop lies northeast of the railroad and parellels it from Osage to Newcastle, and the same is true of the Dakota sandstone which comes to the surface a little farther to the northeast. At several points, notably a short distance west of Newcastle, there are occurrences of oil springs in the Graneros oil-sand outcrop. For many years oil has been obtained at these seeps for local use as lubricants.

It is believed that many of the shallow wells near Osage are obtaining the oil from the thin upper sand and the sandy shales, and that the deeper wells, especially the gushers in Sec. 19, T. 46 N., R. 63 W., have tapped the lower sand. It is not believed that any of the wells are producing from the Dakota or Lakota sandstones. It is probable that the Dakota sandstone will be found to be water bearing in this area. However, there is a possibility that the Lakota and lower sands may be oil bearing in places, and if so the oil will undoubtedly be a heavy black oil with an asphaltum base.

At first the field was largely prospected by the smaller wildcat companies and individual operators, but recently many of the larger companies have taken holdings and are rapidly putting down test wells. Among these are the Midwest Refining Co., the Carter Oil Co., the Ohio Oil Co., the Union Oil Co., the Producers and Refiners Corporation, the Sinclair Oil Co., and other companies and individuals.

The end of this season should see the limits of production fairly well defined in this particular district. A large territory is thus being tested out, and there are possibilities of other pools being developed in addition to the one near Osage. It is more reasonable to assume that there are several oil-bearing areas paralleling the outcrop of the formations and contiguous thereto than that the country will be one solid or continuous oil field, and it is not improbable that many of the deeper wells to the southwest will be outside of the limits of production.

*Abstract of Press Bulletin No. 6 of Wyoming Geological Survey.

NEWS FROM THE OIL FIELDS

Many Applications for Permits Sought Under Leasing Law

Land Classification Staff Busy Defining Geological Structures — Many Existing Maps Incomplete

From Our Washington Correspondent

Applications for prospecting permits and for leases are reaching the U. S. Geological Survey in such numbers as to make it extremely difficult for W. C. Mendenhall and the land classification staff to keep pace in the matter of defining geological structures. The new mineral leasing law provides that prospecting permits may not be granted to cover lands within the known geological structure of a promising field.

While the Survey has geological maps covering a large portion of the public lands, these often are not in sufficient detail. In addition, prospectors for oil are very active just at this time and are appearing frequently in just those spots which have not been mapped geologically. This necessitates prompt dispatch of a geologist to make a survey in the region covered by the application.

The law provides that one applicant may have as many as three leases in a state, but only one lease on a structure. If one person has applied for two leases in the same general region, it must be determined that they are on separate structures. A similar distinction is made with regard to prospecting permits. It is highly important, so far as operation is concerned, to have the line drawn sharply between the territory which is open for permit and that on which permits may not be had and only leases considered. With a permit, it is possible to prospect two years over 2,560 acres. When the permit expires, the holder has a preferential right to lease one-fourth of that area, with the royalty on a five per cent basis. To secure a lease within the structure of a proven field requires compliance with much less liberal conditions. The applicant has no preferential right. The department puts the land up for bids and the highest bidder gets the tract. He must pay a royalty of not less than 12½ per cent and must bid against everyone on the bonus basis.

The Survey already has defined the structures in twelve fields in Wyoming and Montana and six in California. Work is now in progress on six other California fields. The fields where the demand is the greatest are being taken up first. A great many prospecting applications are coming in from New Mexico. As yet, the situation is not intricate in that state, since it has no producing fields. The moment production comes in, however, the urgency of action on the part of the Geological Survey to indicate the boundaries of the structure is apparent.

Kentucky Shows Steady Production Increase

From Our Special Correspondent

Oil production in Kentucky during May reached 667,000 bbl., a new high record, according to figures recently announced by the State Geological Survey. March production was 610,000 and April 635,000 bbl., showing a steady growth. The increased production is due to the numerous wells being brought in in Western Kentucky, and, more recently, to development in Magoffin, Johnson, and Morgan counties.

The Armour Oil & Refining Co., of Pittsburgh, is unloading a heavy rig at Olmstead, in Logan County, for a deep test. A well, it is said, was drilled near Beachland to 700 ft., and the oil ran down the creek several days.

With the completion of pipe lines now under construction in Warren County, it is predicted by oil men that the county will rank first in oil production in Kentucky this month. It was second last month, with Allen County first.

Stein well No. 2 on the Tarrant lease, in the Davenport pool of Warren County, was shot and is reported to be making 50 bbl. per day. Leighty Brothers brought in a well at 450 ft. in 20 ft. of pay sand on the Clint Rigsby farm, a half mile from the Nashville Pike. It is rated at 25 bbl.

A report from Scottsville, Allen County, is that No. 3 on the Cooper lease has been completed at 310 ft. and is rated at 150 bbl. a day.

Oil and Gas in Dover Township, Ont.

From Our Special Correspondent

Further important progress is reported from the Dover oil field, in Western Ontario. The Petrol Oil & Gas Co. has let contracts for five wells, the completion of which will probably require eighteen months. Two of these are under way, one being down about 400 ft. The Vacuum Gas & Oil Co. has its first Dover well down about 1,300 ft. and reports favorable geological conditions. The Ajax Oil & Gas Co. is sinking its first well, and has secured additional leases on 130 acres, increasing its holdings to 160 acres. The Eureka and Inland companies are expected to begin sinking soon.

California crude-oil stocks were reduced 1,165,945 bbl. during June, 1920, according to statistics compiled by the Independent Oil Producers' Agency at Los Angeles, Cal. This daily shortage of 38,865 bbl. shows an increase of over twice the shortage of the previous month, which shows 16,698 bbl. per day.

Texas Well Shows Unexpected Big Flow

Exploration in New Territory Proves Extention of Gulf Coast Field— Other Texas News

From Our Special Correspondent

During the week ended July 24 several important wells were completed in the Gulf Coast fields. On July 20, No. 1 Abrams well of the Texas Co. came in unexpectedly at a depth of 2,780 ft., flowing 15,000 bbl. per day at the start, and increasing to 20,000 bbl., without a sign of water. The great importance of this well, aside from its big flow, is its location, about one mile northwest of the proved field, in practically wildcat territory. This is probably the most important completion of the week in Texas. In the same field No. 26 Japhet of the Humble Oil & Refining Co. was completed during the week, making an initial production of 8,000 bbl. daily. This well is on the west side of the field, and is about 3,300 ft. deep.

Other important completions in the Gulf Coast fields recently were: Humble field, No. 31 Koehler, Texas Co., 3,500 bbl.; Goose Creek field, No. 33 Ashland, Simms Co., showing of oil, now being tested; at Hull field, Empire Gas & Fuel Co., No. 3 Barngrover, 6,000 bbl. at start, but rapidly sanded; No. 33 Dolbear, Republic Production Co., 1500 bbl., No. 35 Dolbear, same company, 500 bbl., No. 19 Dolbear, same company, 400 bbl.; No. 13 Phoenix Gulf Production Co., 400 bbl.

Fire at Desdemona, Eastland County, on July 24 destroyed three business blocks in the center of town, including a bank, three hotels, three cafés, two drug stores and thirteen other stores. Total loss is estimated at $500,000. Desdemona is an oil town, formerly known as Hog Town, and has no fire protection. Dynamite was used to check the spread of the flames. In the Hog Creek field the Harris No. 2 well is flowing 300 bbl. daily, and No. 3 Harris is expected to be completed soon.

The Breckenridge district, Stephens County, production continues to increase. The Plateau well on the Ward tract is flowing stronger, making nearly 7,000 bbl. daily; The Buchanan well on the Gulf Production lease, three and one-half miles east of Breckenridge, is flowing 1,000 bbl. from 2,430 ft.; No. 2 well of Fensland Oil Co., on the Walker-Caldwell tract, was shot and is now making a good flow, not yet gaged.

In Coleman County, the No. 1 well of the Santa Anna Chief Oil Co., seven miles south east of Santa Anna, opened a gas flow of 4,000,000 cu.ft. daily at a depth of 1,540 ft. Deeper drilling may be done. Oil was found in the Pippin-Burke No. 2 well after a second shot.

ECHOES FROM THE FRATERNITY

Plant Devised for Recovering Gems at Burma Ruby Mine

Large Rubies Recovered and Many Small Ones—Test Stones Found in Concentrates Without Loss

Bernard Rance, the chief engineer of the Burma Ruby Mines, has in his annual report an interesting account of an experimental hydraulic sluicing plant, which has been tried on one of the company's properties, the Redhill, according to the London *Financial Times*. This plant was built to his design in the workshops, and made a fair start in August last year. Its object was to try a cheaper method of treating the gem deposits, but at the same time to produce the precious stones. Mr. Rance describes his plant as follows:

"We followed the usual practice, breaking down the bank with jets under moderate pressure, the water being taken from Pamadeik Channel about 500 ft. above the valley, and elevating the material to the top of the sluice by means of an hydraulic elevator under a working pressure of 400 lb. to the square inch, supplied from Redhill Channel. Although the pressure was ample for these duties the volume was restricted to the capacity of 6-in. mains only. The plant consisted of a vertical wooden frame, about 18 ft. in height and 9 ft. square, built immediately over the first bay of the sluice, which carried the screens that prevented the larger stones and pieces of rock from entering the boxes. These screens delivered their stuff on to extension tables, where it was hosed clean and sorted by the sorter in charge. All other sized gravel up to ¾-in. diameter passed through the screens and commenced its journey down the sluice, 100 ft. in length by 9 ft. wide, with riffles placed across at intervals.

"It was at once apparent to me that the methods used for catching gold and tin were of no use when applied to gems, their specific gravity being so much lower than the above metals. With gold having a specific gravity of about 19 it is a fairly easy matter to collect the large coarse grains in riffles and to wash away all sand, quartz pebbles and other undesirable material by using a large volume and rapid flow of water. With our deposit the riffles either packed solid with sand or were washed clean out, according to the flow and volume of water experimented with, owing to the closeness in the values of the specific gravity of corundum, quartz and limestone. After much consideration I then tried a series of boxes, arranging them to take the place of riffles, with rows of 2-in. pipes at the bottom and sides, drilled with numerous small holes to allow rising currents of water under variable regulated pressure to assist in the concentration of the gravel brought in by the sluice water. The results were better than anticipated, and quantities of sand-sized rubies were retained in addition to the larger ones, which tiny things we were prepared to lose altogether. Exactly the same procedure and care as in the sorting sheds was carried out in sorting the deposit, which was drawn out from the boxes by means of sliding doors at regular intervals. The deposit after several hours run was in appearance and character somewhat like that recovered from our pans, but there was certainly sand in excess, which cannot be got rid of without introducing revolving screens, and I particularly wished to bar all running machinery. Marked test stones thrown into the elevator sump were recovered every time. The plant could only deal with about 300 to 500 trucks per shift of ten hours, being limited to the water supply, and the labor required was one sluice man and fifteen to twenty coolies and one European sorter by day.

"The actual figures for the first month's run were: Stones mined valued at Rs9,100 and cost of labor and upkeep Rs1,000. As the total cost of erecting the plant and all materials used in so doing was only Rs6,000, this was a very fair start. . . . Of far more importance than devising a means of extracting the smaller stones is the fact that the plant will retain the large ones, which, after all, are the ones that really matter and decide the paying of dividends."

Will Teach Mineralogy and Blowpipe Analysis

The extension division of the University of California announces that its technical department has a new correspondence course in determinative mineralogy and blowpipe analysis by Arthur S. Eakle, professor of mineralogy. It is equivalent to the course given in the regular session of the university. Each of the ten assignments given in the course is based on portions of a text book which is sent out with the preliminary announcement sheets. The text is entitled "Determinative Mineralogy and Blowpipe Analysis," by Brush, revised by Penfield, 16th edition. The approximate cost is $3.50. With the assignment sheets are sent 100 different kinds of powders and minerals in sets of ten each for experimentation or determination.

The fee for this course is $12, payable in advance. Necessary apparatus for the course must be provided and will be furnished by the Associated Students' Store, Berkeley, Cal., on receipt of a check or money-order for $20.

The Engineer's Part in Industry's Evolution

The mining and metallurgical industry, says the *Écho des Mines et de la Métallurgie*, is evolving an amalgamation of enterprises of singular importance, financial, administrative, and industrial, whose direction had become burdensome and difficult. A single man at the head of a large corporation does not usually suffice for efficient administration.

The direction of these giant enterprises, that have but recently been created, is a large problem.

The head of a great metallurgical or mining company may no longer pretend to see everything and know all about everything connected therewith.

To attempt this would lead him straight to cerebral congestion or cerebral anaemia, and his company to paralysis, for the matters waiting their turn would go months without attention.

Today a chief should in a manner hover above the great business, leaving the cares of its effective direction to his various aides. Here the engineers find their special place, and their role assumes special importance as enterprises evolve toward great concentration.

The actual chief, from his upper plane, should arbitrate the conflicts between his lieutenants; but should leave to them the effective direction of the different branches in order that they acquire the habit and the taste for responsibilities. Without those qualities they will be incapable of successfully filling their own parts in the work.

It is thus incumbent on the head to give careful attention when choosing the chief engineers who are to become his immediate collaborators. Having made this choice, he should leave them to execute, command, and evolve.

Gold Question Discussed Before Salt Lake Club

A meeting in the interests of gold production was held July 23 at the Commercial Club in Salt Lake City by the Utah chapter of the American Mining Congress, which had as its guest at luncheon H. N. Lawrie, economist of the American Mining Congress. Mr. Lawrie discussed the plan for the encouragement of gold production of which he is the originator, according to which it is proposed to offer a premium of $10 per ounce on newly mined gold, and which is embodied in House Bill 13,201, introduced by Representative McFadden of Pennsylvania and now pending before Congress. Mr. Lawrie explained the working of the measure, and answered questions in regard to the various phases of its application.

Book Reviews

Popular Oil Geology. By Victor Ziegler. Composition leather; 5 x 7¼; pp. 171; second edition; John Wiley & Sons, New York. Price $3.

The intention of the author in this little volume is to present a number of general facts for the benefit of the layman who may be interested in the subject, but in this he goes further and includes material that is well within the field of those who have gone more deeply into the subject. As stated in his preface, Prof. Zeigler has drawn liberally on existing petroleum literature, but his selection is excellent and the arrangement of the text is to be commended. It is questionable if the two chapters, "Petroleum Fallacies in Oil Geology" and "Oil Investments," will prove "popular" in certain quarters, as many of the "oily arguments" presented by unscrupulous oil-stock promoters are beautifully exploded. The chapter on "Oil Shales and Their Utilization" constitutes a valuable résumé on this subject, which just now is receiving considerable attention. D. E. A. C.

Exporter's Gazetteer of Foreign Markets. By Lloyd R. Morris. Cloth, 6 x 9, pp. 766. 1920-1921 Edition. Published by American Exporter, New York. Price, $10.

Detailed statistical information regarding foreign markets has been hard to procure heretofore, in compact form. This book has a separate chapter for each foreign country and gives just the data which experience has shown to be most needed by the international trader. Included are data on commerce, production and consumption, language, money, weights and measures, shipping routes, customs, tariff, cable rates, and mail time from New York. The book is up to date and contains chapters on the new states formed as a result of the war. A good index is essential in a work of this kind, and in this instance this feature seems particularly complete.

Technical Papers

Mineral Statistics — The following separate papers have recently been issued by the U. S. Geological Survey. They will later be incorporated in the annual volumes of "Mineral Resources of the United States": "Cadmium in 1919"; "Barytes and Barium Products in 1918"; "Cobalt, Molybdenum, Tantalum, Titanium, Radium, Uranium and Vanadium in 1918"; "Nickel in 1918"; "Feldspar in 1918"; "Lime in 1918"; and "Introduction and Summary of Mineral Production in the United States in 1917."

Sampling—The State School of Mines at Butte, Mont., has recently issued a seventy-one-page bulletin entitled "Mechanical Ore Sampling in Montana," which may be obtained on request. Montana has several large sampling mills, and in this report are described those of the Anaconda company at Butte and Anaconda, that of the East Butte company at Butte, and those of the American Smelting & Refining Co. at East Helena. Several test lots were run through the different mills, the samples checking remarkably well and proving the machinery and general procedure to be all that could be desired. The bulletin does not discuss sampling from the mathematical standpoint, but merely analyzes the sampling methods in use in Montana and suggests the most fertile fields for improvement. Many illustrations add to the reader's interest.

Molybdenum — The Climax Molybdenum Co., 61 Broadway, New York, has recently published an artistic and informative book entitled "Molybdenum Commercial Steel." Alloy steels in which molybdenum is used were developed largely under war conditions when other alloying materials were scarce, but they seem to have proved satisfactory for many purposes for which other types of steel were formerly used. This book will be of interest to molybdenum producers as suggesting outlets for their product, as well as to steel users who may profit by the use of this modern alloy.

Manganese—A report on the manganese deposits of the Australian Manganese Co. is contained in the Mining Review No. 31 of the South Australia Department of Mines, Adelaide. A large number of analyses and a detailed description of the workings are given. Some general information and data are also appended on the manganese deposits and industry in other parts of the world.

Economics of Gold—A discussion of "The Gold Premium" occupies about twenty pages of the May *Journal of the Chemical, Metallurgical and Mining Society of South Africa* (Johannesburg, price 3s.). Any one interested in the currency systems of the world should find it worth perusing.

Commercial Terms—In the May and June issues of *Anglo-American Trade* (8 Waterloo Place, Pall Mall, London, S.W.1, price 1s. each) are published articles discussing and defining the terms f.o.b., f.a.s., c.&f., c.i.f., and l.c.l. The English interpretation of these terms is sometimes different from the one to which we are accustomed and exporters and importers not already familiar with this matter should give the subject attention.

Missouri War Records—The School of Mines and Metallurgy of the University of Missouri, Rolla, Mo., has issued a bulletin containing the war records of all of its members.

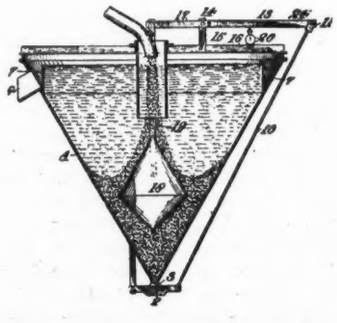
Recent Patents

1,346,642. Process for the Extraction of Lead and Zinc From Their Ores. Frank Edward Elmore, Boxmoor, England. Filed April 1, 1919.

Process for separating lead compounds from zinc compounds in lead-zinc sulphide ores, concentrates or the like, consisting in heating the pulverized ore with a sufficient quantity of strong hydrochloric acid until substantially the whole of the lead has been converted into lead chloride while the zinc remains substantially unattacked, cooling the heated mixture, washing the mass with a limited quantity of cold water to remove excess of acid and soluble impurities, then separating the lead chloride from the zinc by extraction of the former with a hot solution of lead chloride in water or in strong brine, separating the solution from the undissolved matter and cooling it to crystallize lead chloride, separating the mother liquid from the crystals and using it when reheated to leach a further batch of lead chloride from zinc sulphide, the process being repeated so that the same quantity of solvent serves repeatedly to convey purified lead chloride to the crystallizing vessel, while leaving zinc sulphide in a condition suitable for metallurgical treatment, heating the crystallized lead chloride with sulphuric acid, dissolving the evolved hydrochloric acid in water and using the solution for treating a further batch of the ore.

1,344,370. Automatic Density - Indicator for Slime-Pulp Separators. Charles Allen, El Paso, Tex. Filed April 3, 1919.

In a device for separating a feed stream into two products, each of a different density, a receptacle having a separate outlet for each of the products, a valve for controlling the outlet for the heavier product, means automatically responsive to the variations in the density of the heavier product to control the discharge valve, an indicator



operatively connected to the control means for indicating the density of the discharge material, and means in connection with the indicator to set the control means so that the discharge will occur only when a predetermined density is reached.

COURT DECISIONS IN MINING CASES

By Wellington Gustin

COLORADO

Right To Redeem Declared A Personal Privilege

Camp Bird Mining Co. Not Permitted To Acquire Mining Properties of the Brant Independent Mining Co.

The United States Circuit Court of Appeals, Eighth Circuit, has reversed the District Court for Colorado, which had issued an order allowing the Camp Bird Mining, Leasing & Power Co. to redeem from the foreclosure sale of the Brant Independent Mining Co. The trial court had no authority or evidence upon which to base a decision that the redemption of the Camp Bird Mining Co. was in the interest of the Brandt company, the mortgagor, whose properties, consisting of real estate, mining claims, mining locations, water rights, mill site, office building and furniture, assay offices and instruments, houses, stables, teams and mining and milling machinery, had been sold under foreclosure proceedings.

The only right or authority under which the Camp Bird company claimed a right to redeem the property was an agreement made in May, 1914, between the Brant company, as lessor, and T. R. L. Daughtrey & Co., as lessee. In this agreement the lessor leased to the lessee for the purposes of development and mining the following mining claims: Paonia, Morning Glory, London, Copper Sulphide, Protection, Option No. 1, Option No. 2, Option No. 3, Option Fraction, and Contec Lode, or Winnie Fraction, together with certain real estate and improvements and the ten-stamp mill at Bowerman. The lease was for ten years from Aug. 10, 1914. The lease was assigned to the Camp Bird company.

This agreement was an ordinary mining lease for the purpose of development, the consideration therefor being a royalty of the net profit. There was no conveyance of any interest in the property leased to the lessee. The Camp Bird company was owner of $44,100 of the bonds of the Brant mining company secured by the mortgage which was foreclosed. The total amount of the bonds issued under the mortgage was $87,000. The Camp Bird company was therefore holder of a majority of the bonds, and as such holder demanded foreclosure of the mortgage.

George Hetherington, as trustee, bid the property in for the minority stockholders and bondholders. The Camp Bird company was also a bidder at the sale. It attempted to redeem the properties from the trustee, claiming the right, under its lease, to treat the redemption as having been made by it for the Brant mining company.

The Court of Appeals said there was no evidence that the Brant company ever requested the Camp Bird company to redeem from the sale, and as the right to redeem was a personal privilege, the Brant mining company could not be compelled to exercise it by its lessee. The redemption of the Camp Bird company was in its own interest, and it had no authority under the Colorado statute to act. The trial court was, therefore, directed to enter a decree cancelling the pretended certificate of redemption.

SOUTH DAKOTA

Contract Need Not Be Reciprocal

Transcontinental Petroleum Co. Granted New Trial in Suit Against Inter-Ocean Oil Co.

Judgment for the Interocean Oil Co. in the action brought against it by the Transcontinental Petroleum Co. in the District Court of South Dakota has been reversed and new trial ordered by the Court of Appeals, Eighth Circuit, and a new hearing has been denied the parties.

The action arose out of contract between the parties for the sale by the Transcontinental company of the Republic of Mexico, to the Interocean company, of 1,200,000 bbl. of Mexican crude oil produced in the Panuco oil fields, near Tampico, Mexico. The contract provided that deliveries in any quantity were limited to the actual production of the oil wells owned or controlled by the seller, and that deliveries were to be at the rate of 50,000 bbl. per month from Jan. 1, 1914, to Dec. 31, 1915. The breach of contract claimed was the failure of the buyer and its assignee to take a large part of the oil contracted for. On trial the court gave judgment for the buyer, defendant, who sought to avoid the full obligations of the contract, claiming lack of mutuality in its terms.

The Court of Appeals, in reversing the judgment, said that a sale, where the quantity to be delivered or received is measured by the output or requirements of an established plant or business during a limited time, does not lack mutual obligation. Farther, it held a contract, by a corporation operating twenty oil wells, to sell a stated quantity of crude oil, to be delivered during two years, not invalid for lack of mutual obligation of the parties, because of a provision limiting its obligation to deliver to the production of its wells then owned or afterward acquired during the time. This provision also limits the buyer's obligation to receive such production.

WASHINGTON

Statutes Not Applicable to Exploitation Risks

Josevig-Kennecott Forced To Transfer Stock—Contracts Involving Uncertain Contingency Not Usurious

The United States Court of Appeals has affirmed the decree of the District Court for the Northern Division of the Eastern District of Washington, requiring the Josevig-Kennecott Copper Co. to transfer to the James F. Howarth Co. 260,000 shares of the Copper company's treasury stock.

The controversy arose out of a contract in writing entered into between the Howarth company and George Francis Rowe, therein represented to be the sales manager and fiscal agent of the Copper company, with power to sell 1,000,000 shares of its treasury stock. The Copper company asserted in the suit that it was not informed of this contract until several months after it was executed. Nevertheless, on July 17, 1916, the date of the contract, the Copper company, by its president, wrote to the Scandinavian American Bank, informing it that 1,000,000 shares of the Copper company's treasury stock were deposited with it, and that the bank was authorized to issue to the Howarth company 260,000 shares thereof, and on July 18, 1916, the latter company, together with all the stockholders of the Copper company, entered into a pooling agreement, in which the Howarth company was represented as holding 260,000 shares of the Copper company's stock.

The contract provided that the Howarth company should advance to the Copper company $10,000, "to be used in the exploitation of said copper company," that out of the proceeds of the sale of stock of the company 25c. per share should be set apart for the repayment of the Howarth company, that as additional compensation for services rendered the latter should receive 260,000 shares of the promotion stock, and that if the stock-selling campaign should prove unsuccessful the Copper company should not be obligated to repay the Howarth company the money so advanced.

The Copper company contended that this contract was usurious. But the court said the usury statutes "have no application to those uncertain transactions in which the person who furnishes the money needed incurs risk of losing in whole or in part the principal sum loaned." (39 Cyc. 943.) Here the money was loaned for the exploitation of undeveloped mining property, with the understanding that its repayment depended upon the venture's success.

MEN YOU SHOULD KNOW ABOUT

E. F. Hall is the new superintendent of the mine and mill at Leadville, Nev.

A. W. Newberry has returned to New York on the "S. S. Olympic" after an absence of two months abroad.

Arthur Keith has recovered from his recent illness and has gone to Greenfield, N. H., to do geologic work.

M. J. Gavin, who is in charge of oil shale work for the Bureau of Mines, is in Washington on official business.

Prof. H. H. Stoek is in Washington compiling figures pertaining to accidents in mines.

Charles Butts is studying Mississippian formations in the Frankfort, Ky., area.

E. E. Carpenter, for a number of years manager of the Nevada Wonder, is now in charge of active operations for the Candelaria Mines company.

Raymond Guyer, of New York, recently inspected mines at Ely, Battle Mountain, and Goldfield, Nev., for which he is consulting engineer.

G. B. Richardson will spend a month in Kentucky for the U. S. Geological Survey, collecting statistics on oil production.

John Edwin sailed July 27 for Dutch Guiana, where he will engage in exploration work for the Surinaamsche Bauxite Maatschapij.

F. H. Skeels has been appointed superintendent of the Ramshorn Mine of the Ramshorn Mines Company. The mine is at Bayhorse, Idaho.

H. W. Hardinge sailed for London and the Continent on business matters on the "S. S. Aquitania" July 31. He will return to this country about Oct. 15.

S. K. Bradford, for some time a field man for the West End Consolidated Mining Co., of Tonopah, Nev., is now located in Virginia City, Nev.

H. A. Linke, mining engineer of Salt Lake City, Utah, and **A. G. Burritt** are examining the fossil oil fields of Lincoln County, Wyo., and mapping the district.

H. H. Stoek, professor and head of the department of mining engineering at the University of Illinois, recently received the honorary degree of D.Sc., from the University of Pittsburgh.

Roy H. Elliott, chief engineer for Bulkeley Wells' syndicate, recently made an inspection of his client's Comstock properties, as well as the dredging operation near Dayton.

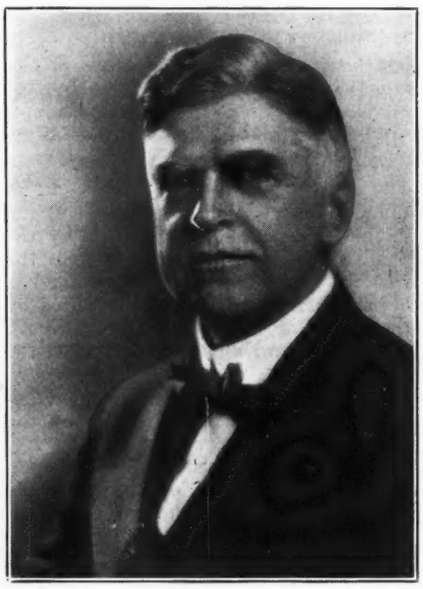
Arthur Crowfoot, superintendent of concentrators for the Arizona Copper Co., has returned to Morenci, Ariz., from a business visit to Chicago and New York.

Col. M. G. Baker, vice president of the Vanadium Corporation of America, sailed from New York on July 28th for the company's properties in Peru. He may be gone for several months.

Frederick B. Tough, of the U. S. Bureau of Mines, has been appointed supervisor, with headquarters at Denver, to look after matters pertaining to the regulations issued under the Mineral Leasing law.

Walter K. Mallette, a metallurgical engineer who has been in the service of the U. S. Bureau of Mines, has resigned to accept employment in the Cia. Carbonifera de Sabinas, Rosita, Chihuahua, Mex.

James Colquhoun, who some years ago was general manager for the Arizona Copper Co., and who when war broke out in Europe in 1914 was in charge of important mines in Russia for an English company, has just concluded a lengthy visit to Clifton, Ariz.



GEORGE S. RICE

George S. Rice, chief mining engineer of U. S. Bureau of Mines, is visiting the Western experiment stations of that Bureau. His itinerary includes Denver, Col.; Butte, Mont.; Salt Lake City, Utah; Berkeley, Cal., and Seattle, Wash. Mr. Rice will stop at Houghton, Mich., to attend the meeting of the American Institute of Mining Engineers.

T. H. Arnold, who has been in charge of the electrical department at the Arizona Copper Co.'s mines in Clifton-Morenci district, Arizona, has resigned to accept a position with a cement manufacturing company of El Paso, Tex.

Prof. Charles H. Fulton has resigned as professor of metallurgy at the Case School of Applied Science to become head of the mining department at the Missouri School of Mines at Rolla, Mo. Within the last few years Professor Fulton has perfected an electrical resistance furnace for smelting zinc ores.

D. H. Newland, formerly with the New York Geological Survey, has resigned to accept a professional position with Beaver Board Companies, Buffalo, N. Y. Mr. Newland recently examined the properties of the American Cement Plaster Co. taken over by the Beaver Board Companies.

G. E. Goodspeed has rejoined the staff of the Oregon Bureau of Mines for summer field work as mining geologist. He is at present completing a geologic report on the Blue Ledge mine in southern Oregon and will then make ar extensive study of the gold mines in the Cornucopia district of northeastern Oregon.

Robert N. Bell, state mine inspector of Idaho, has formally announced that he will not be a candidate for re-election, and that he will retire to give his attention to the practice of mining geology and engineering. He will maintain an office in Boise. With the close of his present term Mr. Bell will have served as mine inspector sixteen years, continuous with the exception of two years.

T. Nelson Dale, geologist, is the only member of the scientific staff of the U. S. Geological Survey who will retire at an early date under the recent Act for Retirement of Government Employees. Mr. Dale has been for a long period on the geological staff of the Survey, engaged particularly in economic geology studies of building stones. **F. W. Clarke**, chief chemist, and **William H. Dall**, geologist and paleontologist, are both of retirement age, but under the provisions of the act will be retained in active service for an additional period. No members of the scientific staff of the Bureau of Mines is affected by the act of retirement.

H. A. C. Jenison, the geologist who has just taken charge of copper statistics for the U. S. Geological Survey, was born at Roxborough, Ireland. His early education was obtained at the Blackwater preparatory school and at Harrow, England, where he was graduated in 1904. He continued his technical work at both the Universities of California and of Washington. He completed his work at the University of California in 1907, and left immediately for South America, where he entered the services of the Central Chile Copper Co., Ltd. Later he was sent to Ecuador to do copper exploratory work. Late in 1910, he returned to California and was engaged for a year in the copper mines in the northern part of that state. The next year he spent in British Columbia, after which he was engaged for a year at Santa Rosalia, in Lower California, and in the State of Sinaloa, Mexico. The copper industry of Alaska claimed his attention until the war broke out, when he entered the U. S. Army as a second lieutenant. He served in France until retired by severe injuries received in action. He was in the hospital until October, 1919, when he entered the service of the U. S. Geological Survey as an associate mineral geographer. His experience in copper led to his recent appointment.

THE MINING NEWS

LEADING EVENTS

Wide-Spread Strike in Mexico Settled by President

Over 30,000 Men in Mining Camps and Oil Fields Return—40 Per Cent Wage Increase Granted

What promised to be the most disastrous and wide-spread strike in the history of Mexico was settled at least temporarily on July 27 by the intervention of the President of the Republic, who asked the strikers to return at once and abide by the decision of a joint committee to be appointed to go over the whole situation involved. Ten thousand men were out in the oil regions of Tampico; 6,000 men of the A. S. & R. and the Cia de Minerales y Metales at Monterrey; 1,800 of the Mazapil Copper Co.; 5,000 at the Matehuala mines; and about 10,000 in various small mining camps throughout Durango and Chihuahua. As the strike had effected the fuel oil supply another five days would have thrown 300,000 men out of employment in the various mining regions of the country. Upon receipt of a telegraphic request by the President the miners' committees and representatives of the mines got together and a temporary advance of 40 per cent on the average was granted the workers.

The companies still refuse to recognize the unions and are standing out for the open shop. It is understood that the government will bring strong pressure to bear on the companies for a general recognition of the unions. The men are apparently satisfied for the present with the scale of wages that is being paid.

Federal Co.'s Shaft on Russell Claim One-Fourth Completed

Shaft sinking on the Russell claim to prove that the Hecla Mining Co.'s "east" vein apexes within its boundaries is progressing rapidly under the direction of the Federal Mining & Smelting Co., which took over the work from the Marsh Mines Consolidated. The work has reached a depth of 240 ft., the total distance to be sunk on the dip of the vein in following the latter into Hecla ground being about 1,000 ft. A new hoist has been installed by the Federal company, the shaft has been placed in a more workable condition and perfect ventilating facilities have been provided, the necessity for the latter having been tragically demonstrated by the death of three men in the shaft about two months ago through the presence of monoxide gas. The Federal company is the owner of the Russell claim and plaintiff in the case against Hecla.

WEEKLY RÉSUMÉ

A strike in the oil fields and mining camps of Mexico that threatened to become general was settled on July 27, the companies agreeing to a temporary wage increase of 40 per cent. The Democrata Mining Co. at Cananea has shut down owing to high costs. The Vanadium Corporation of America is further increasing its transportation facilities at its mines in Peru and has contracted for another railroad link. The Alaska-Treadwell's first shipment of ore from its claims at Nixon's Fork in the Kuskokwim Valley has reached Tacoma. The Federal Court has decided against the Chicagoff Mining Co. in the suit brought by John Tuppola. Canada Copper is to be reorganized.

In California, mine owners of Amador County have protested against the act of the Pacific Gas & Electric Co. in curtailing its power service. In Montana, Anaconda is reported to be planning to double the capacity of its rod and wire plant. In Utah, a sampling mill of the A. S. & R. Co. was burned at Murray.

Chicagoff Mining Co. Loses Suit in Federal Court

The U. S. Circuit Court of Appeals in Alaska handed down its decision recently awarding John Tuppola two mining claims valued at $500,000 and ordering an accounting for all profits made by the Chicagoff Mining Co., of Alaska, since 1914.

Fraud was charged against the Chicagoff company by Tuppola. He maintained that to gain complete possession of the four claims in which he was joint owner with the company, he was charged with insanity, tried and sentenced to an asylum and that subsequently the claims were sold by a guardian for $1,000. Tuppola was liberated from the asylum in December, 1917, and brought suit in the Alaska court to recover his holdings but was defeated. His victory in the Federal Court gives him possession of two claims near Sitka and one-half interest in the claims held by the defendant.

Judge Ellis, who handled the case for the mining company, states that a rehearing will be asked for. He asserts that the court found no evidence of fraud but that it was simply a matter of law as to the validity of a guardian's sale. W. R. Rust, Hugh C. Wallace, both of Tacoma, are among the principal owners of the company.

Copper Refinery Rumored for Miami District

A story has been given circulation in the Miami district of Arizona to the effect that a copper refinery and an acid plant are to be added to the International Smelting Co.'s plant there. The story was denied at the company's New York office.

Vanadium Corporation To Build Second Railroad Link

Will Supplant Motor Haulage—Construction of Small Power Plant Started—New Ore Located

A contract has been placed by the Vanadium Corporation of America with the Foundation Company for a railroad in Peru over the 25-kilometer stretch between Casa Laguna on Lake Pun Run and the Cerro de Pasco railroad at Ricran. Only recently a motor highway was completed between these points, making the use of llamas for transporting ore unnecessary. It is expected that the saving made by employing rail transportation instead of motor haulage from the lake to Ricran will be considerable. The new line, to be ready early in 1921, will give the company rail or water transportation all the way from its mines to this country. A narrow-gage road between the mines at Minas Ragra and the bluff overlooking Jumasha on the shore of the lake was completed a few months ago.

Construction of a 500-hp. hydro-electric plant on the Jumasha River between the mines and Lake Pun Run has been started. This will supply power for the mines and for diamond drilling. Recent drilling operations indicate the existence of another extensive body of vanadium ore lying some distance below the one already known.

At present the mine waters are carrying considerable vanadium ore into the lake where a deposit is building up at the point of discharge. Steps will be taken to recover this, though the method to be employed has not been announced. It is believed that the saving from this item alone will amount to about a quarter million dollars a year.

Ore from Alaska-Treadwell Co.'s Nixon Claims Reaches Tacoma

The motor schooner "Ozmo" arrived recently at the A. S. & R. smelter at Tacoma, Wash., with the first shipment of gold ore from the Alaska Treadwell's property near Nixon, Alaska, 60 miles from McGrath, in the Kuskokwim River district. The ore was carried down the Kuskokwim River in small boats and loaded abroad the motor schooner at Bethel. It is stated that development work on this group of mining claims is proving decidedly encouraging and additional equipment is being ordered to supplement mining work. These are the claims on which an option was secured for the company last summer by Livingston Wernecke, geologist for the Alaska-Treadwell, while he was on a scouting trip.

NEWS FROM WASHINGTON

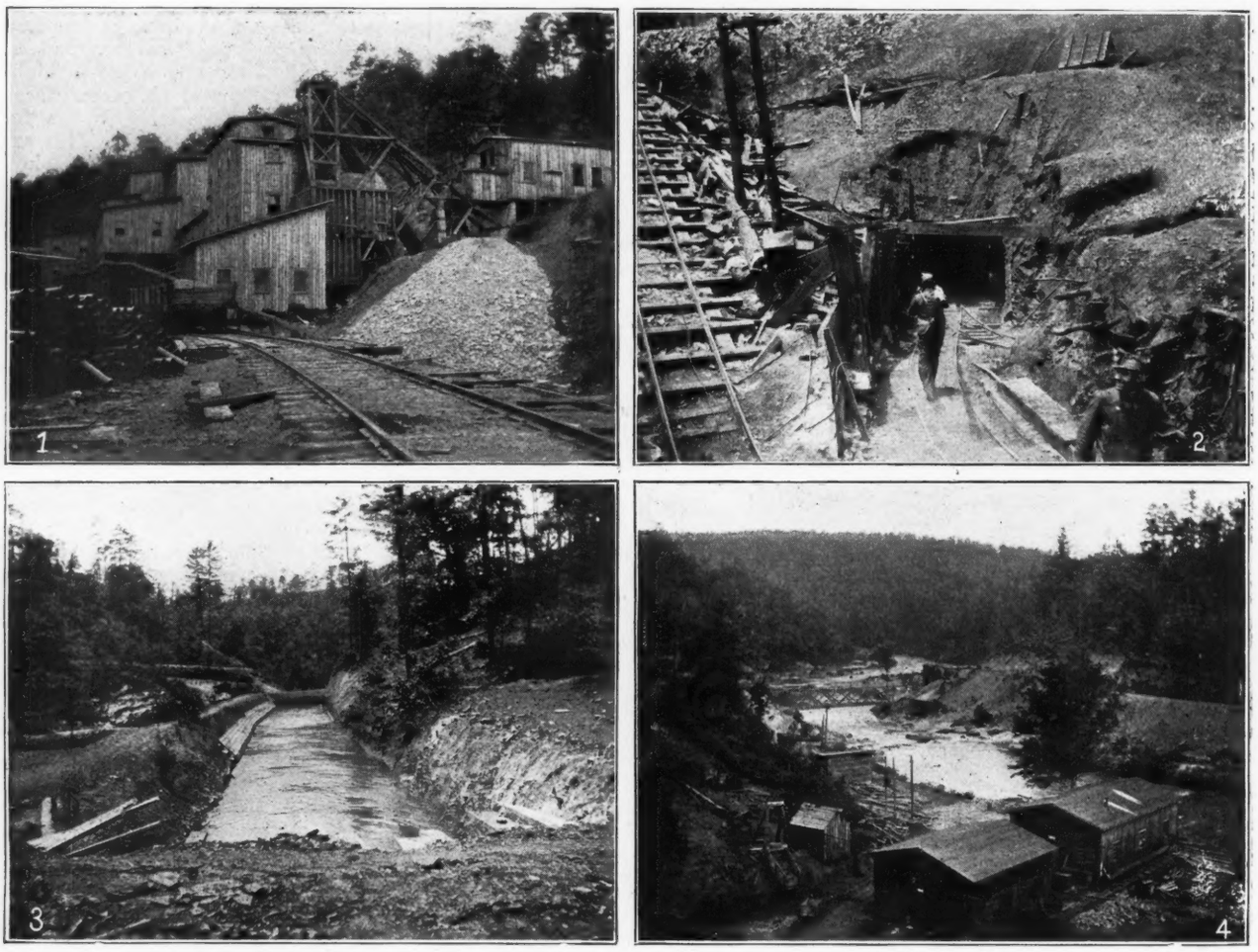
By PAUL WOOTON
Special Correspondent

Claims for War Minerals Relief Often Obviously Unjustified

In analyzing the claims disallowed by the War Minerals Relief Commission, it is surprising to note the number of claims made where it should have been obvious that the claimant had no case. For example, one claimant admits, in his questionnaire, that he had made a profit of over $70,000 in mining and shipping ore from his property but nevertheless he put in a claim of $1,700 for ore which remained in his hands unsold at the time of the armistice. Since he suffered no net loss, the claim naturally was disallowed upon examination by the commission.

In the accompanying illustrations is shown the plant of the Chestatee Pyrite & Chemical Corporation, at Chestatee, Ga., discussion of whose claim for a large sum occupied so much of the time of the House Committee on Mines and Mining during the last session of Congress. The Chestatee company was awarded a fraction of its claim, which it accepted under protest.

Awards were recommended by the War Minerals Relief Commission during the week ended July 24, as follows (the name of the claimant, the mineral, the amount recommended and its percentage relationship to the amount claimed are shown): P. H. Bray, manganese, $1,404.03, 14 per cent; Western Rock Properties Co., manganese, $14,106.80, 24 per cent; Liberty Chrome Mines, chrome, $778,46, 34 per cent; Lydia Blakemore, manganese, $639.30, 36 per cent; Pacific Tungsten Co., tungsten, $92,590.01, 21 per cent; Butte Central Mining & Milling Co., manganese, $42,457.50, 24 per cent; Mrs. Ruth A. Scurlock, manganese and chrome, $1,456.77, 60 per cent.



NO CLAIM FOR RELIEF UNDER THE WAR MINERALS ACT HAS ATTRACTED SO MUCH ATTENTION AS THAT MADE BY THE CHESTATEE PYRITE & CHEMICAL CORPORATION, OF CHESTATEE, GA., VIEWS OF WHOSE PROPERTY ARE SHOWN HERE. 1. GENERAL VIEW OF MILL. 2. ADIT AT NO. 1 LEVEL. 3. RACEWAY, LOOKING TOWARD POWER HOUSE. 4. FORGE AND MACHINE SHOPS, LOOKING WEST

Increased Freight Rates Hit Low-Grade Ores

Commission Holds Exceptions to General Percentage Increase Not Warranted Now

No exceptions were made of low-grade ores by the Interstate Commerce Commission in ordering its general percentage increases of freight rates. In that connection, the commission said in handing down its opinion:

"In some of the western states there is a considerable movement of low-grade ores, some of which are valued at $5 per ton or less. Shippers of these low-grade ores contend that further increases in the rates thereon will result in curtailing or destroying their movement. The evidence before us in this proceeding, however, does not warrant exceptions to the general percentage increases at this time."

With regard to iron ore, the commission's opinion reads:

"A considerable proportion of the iron ore consumed in the United States originates on ranges in Minnesota and Michigan near the head of Lake Superior. This ore moves to furnaces on Lake Michigan and Lake Superior; to furnaces on Lake Erie and in Pennsylvania, Ohio, and other states. The movement is by rail to the upper lake ports, and when destined beyond, by lake vessels to the lower lake ports.

"Because of the keenly competitive situation between the respective furnaces, the Director General adopted a specific increase of 30c. per ton upon iron ore in lieu of a percentage, which was applied to the movement from the Michigan and Minnesota ranges to the upper lake ports, but not from lower lake ports to eastern destinations, thus resulting in an equal increase in cents per ton for the rail transportation to each of the competing furnaces. Under this plan the rates of the western carriers up to the lake ports were increased approximately 57 per cent, whereas the rates of the eastern carriers from the lower lake ports were not increased.

"In this proceeding the eastern carriers propose first to apply an increase of 22c. per ton and then impose thereon the general percentage increase. The testimony of ore shippers is conflicting, some proposing no further increases from the ranges to the lake ports, some favoring double increase in the rates from the lower lake ports, others proposing no exceptions to the general percentage increases proposed on traffic generally.

"The returns made by the principal ore-carrying roads from the Minnesota ranges to Lake Superior ports indicate that such lines are in a much more prosperous condition than the western carriers generally.

"It is concluded that at this time no increases should be made in the rates on iron ore from the Minnesota or Michigan ranges to Lake Superior or upper Lake Michigan ports. Other rates on iron ore may be increased according to the percentages herein approved."

Survey Defines Meaning of "Ore"

With a considerable portion of the gold ore extracted at the present time resulting in a loss to the operators, special significance attaches to the definition of "ore." The generally accepted definition implies that ore is a mineral or an aggregate of minerals from which one or more metals can be extracted at a profit. So far as the U. S. Geological Survey's statistical reports are concerned, the term "ore" will be held to mean minerals or aggregates of minerals containing one or more metals which have been shipped to treatment plants and for which the miner has received payment regardless as to whether or not the receipts cover the cost of mining and reduction. This applies to placer gold as well.

The Survey's records show that there are numerous cases where minerals have been extracted during the last year at a loss, but the operators have found it more economical in the long run to keep their properties in operation.

Federal Reserve Board Summarizes Industrial Conditions

Commenting on metal mining conditions during July, the Federal Reserve Board's summary of business conditions says:

"Metal mining conditions during the month have not been uniform. In District No. 10 (Kansas City) the half-year period ending June 30 shows an increase in the value of lead and zinc shipments over 1919 in spite of adverse productive conditions. Shipments of zinc ores declined during June and there was a tendency to decline both in price and volume of shipments of zinc. Metal mining in Colorado has suffered from a shortage of labor."

Nevada Gold Mining Continuing in Spite of Conditions

F. S. Schrader, of Geological Survey, Reports on Activity of Jarbidge and Other Districts

Gold mining operations are far from being at a standstill in Nevada, according to F. C. Schrader, of the U. S. Geological Survey, who just has completed a visit to several of the camps in that state. He is particularly impressed with the activity being displayed in the Jarbidge district. This district produced more gold in 1919 than did any other camp in Nevada and has produced more of the metal thus far in 1920 than it did during the corresponding months in 1919.

One of the distinct assets of the district, Mr. Schrader reports, is its cheap power, which is secured from the Thousand Springs Power Co., near Buhl, Idaho. Ample power is available at the Idaho state rate. A new power line has just been run into the district. Much development work is being done and a number of new veins are being opened. The principal companies operating the districts are the El Koro Mining Co., the Jarbidge-Buhl Mining Co. and the New York-Jarbidge Mining Co. In addition, there are a number of other companies working on a smaller scale.

In the Rawhide and Rand districts, only the higher grade gold ores are being worked, but Mr. Schrader found everyone taking a hopeful view of the situation. He also visited the new Broken Hills district, which is located near Rawhide in the outskirts of the Carson Sink region. He finds that the district has good surface showings of silver. The deepest working at the time of his visit was not lower than 150 ft. but the indications at that depth he regards as very favorable. There is good ore continuing from the surface to that depth. Sulphides begin at the 100-ft. level. The camp is dry. Water must be hauled fifteen miles across desert country.

NEWS BY MINING DISTRICTS

MEXICO

Sonora

Democrata Company Shuts Down—Calumet & Sonora Planning Changes in Mill

La Cananea—The Democrata Mining Co. at Cananea is closing down owing to the high cost of materials and labor. The smelter will be operated until all coke on hand has been used. There will probably be enough to keep its one furnace running until about the middle of August. The mine pumps will be pulled and the plant completely shut down. This property has been a small but consistent producer since 1912, operations having been suspended in 1917 when its new power plant was under construction. About 5,000,000 lb. of copper has been produced on the average for the last several years. The smelter has three blast furnaces and a converter. The mine will not be reopened until there is a more satisfactory price for copper. For some time operations have been extensively curtailed. At present about 300 men are being employed. The property is owned by C. E. Hoffman.

H. S. MacKay, superintendent of the Democrata Mining Co., has been appointed consulting engineer for the Calumet & Sonora Mining Co. Considerable development work has been planned at this property. The main shaft will be sunk below the 700 level and the Catalina shaft will be reopened. Certain changes in the mill will also be made.

The mine is producing about 300 tons of lead-zinc-copper ore. A lead concentrate and a copper-zinc concentrate are being made in the gravity mill. The copper-zinc concentrate is treated in an electrostatic mill which produces a clean copper and a zinc concentrate. The copper concentrate is shipped to the Cananea Consolidated Copper Co.'s smelter and the zinc is exported to the United States.

Mexico

Mexico City—In order to encourage a resumption of mining among the smaller owners, or at least induce small owners to resume payment of taxes, the government has issued a decree rescinding all previous decrees confiscating properties for failure to pay taxes, and will permit owners to make payment of back taxes on easy installments. The text of this decree was published in the last issue of *Engineering and Mining Journal*. The government was also induced to take this step as in many parts of the country mining records have been completely destroyed and the mining offices have no way of checking up ownership except where the owners voluntarily present themselves for tax payments. The decree has been well received and will probably be the means of getting several thousand mines on the rolls which have been dodging their taxes up to the present. More than three-fourths of the mine owners have not paid taxes in years, partly because of the unsettled conditions of the country, and partly because of extraordinary decrees and laws which discouraged many from a resumption of work.

ALABAMA

Woodward Company's Bessemer Mines Again Producing Regularly—Cars for Finished Products Scarce

Birmingham—The Woodward Iron Co. is again getting its regular supply of ore from its mines in the Bessemer district, Red Mountain, 12 miles south of Birmingham, where fire recently destroyed the boiler house, including machinery on which mine operations depended. The company has four blast furnaces in operation and a steady production of ore is necessary.

The operations of the Tennessee Coal, Iron & Railroad Co. on Red Mountain, between Birmingham and Bessemer, at Wenonah, Fossill and other points, are progressing steadily. Labor is being brought in and made as comfortable as possible. Electric lights, improved water service, better housing, schools and other improvements are being provided. Practically all the labor at the mines is colored.

The development of the deep-ore mining project of the Gulf States Steel Co., at Shannon, about 8 miles south of Birmingham, is being pushed and before January 1 it is expected there will be a production sufficient for present needs of the company and more. The company is at present getting ore from the Crudup mines, in Etowah County and elsewhere. Needs range between 750 and 800 tons daily. The ore that is to come from the Shannon mines will be of higher grade than that now used. At the Shannon the slope has reached the ore and an entry started. The slope has been concreted. Expectations are that within a year the daily output will be double the amount needed and that some may be offered on the open market.

Ore properties over the Alabama line in Georgia and in northern Alabama are being inspected with a view to development before long. Some negotiations are reported to be under way for the Trussville and Rome (Ga.) furnace propositions for which ore will be absolutely necessary.

Although there is dire need for railroad equipment with which to move finished products, pig iron, steel and steel shapes, there is but a slight interference in the intra-district haulage, the cars in the ore region not being very difficult to obtain, though a different kind is used in hauling ore. One or two of the pig iron companies in the Birmingham district have purchased railroad equipment for transporting ore to furnaces. Thousands of tons of pig iron and steel are to be seen in yards of the district, the railroads being unable to move them.

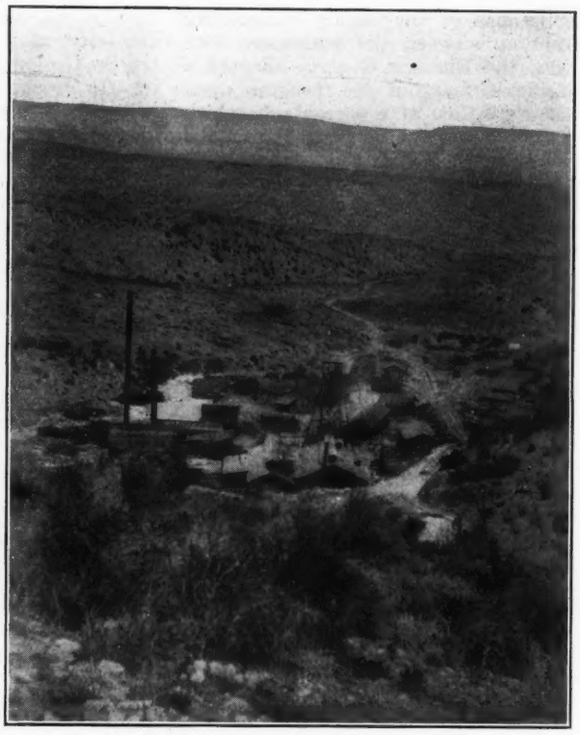
It has been announced that when the full equipment on the Warrior River is in service, in about 60 days, there will be steady shipments of Chilean ores from Mobile to the Birmingham district, providing a fairly good up-river traffic. As it is now there is very little or nothing coming up stream. Coal, steel shapes, lumber and other products in quantity are being shipped down river. The Chilean ores are being used in several industries of this district, at the manganese plant at Anniston in particular.

ARIZONA

Jerome Verde Planning for Further Development—Electrifying Jerome Superior's Surface Plant Completely

Jerome—The Jerome Verde is planning to raise funds for extensive development in the Main Top shear zone. It is considered important that development be continued on the 1,200-ft. level, which is 100 ft. deeper than any other working place and within a few hundred feet of the best ore shoots on the 1,100-ft. level. A failure of the present plan would endanger the rights of stockholders, for funds are insufficient to meet expenses of long idleness. H. P. Henderson is consulting engineer and John B. Harper manager.

Hopewell—Jerome Superior's surface plant is being electrified throughout. An additional compressor with a capacity of 1,125 cu.ft. per min. is to be installed, with a 200-hp. motor to drive it. A 75-hp. motor is being added to the hoisting equipment. This will increase the hoisting speed from 300 to 450 ft. per min. The shaft is down 860 ft. and will be sunk to 1,000 ft., at which level additional lateral work will be started. As the shaft gains in depth, the flow of water steadily increases. A new pump for the 1,000-ft. level has been delivered. A water softening plant will be installed. George Mitchell is general manager.



PLANT OF JEROME SUPERIOR COPPER CO., JEROME, ARIZ.

CALIFORNIA

Amador County Operators Protest Against Power Curtailment—Alta-California Discovers Old Channel

Sutter Creek—Drifting from the 3,850-ft. level of the main shaft of the Central Eureka has begun, and all efforts will be concentrated on opening several orebodies thought to lie within 50 ft. of the shaft. The mill continues to crush ore and the output is normal.

The Amador Queen has been taken under lease for 16 months by M. F. Thomas and preliminary work begun. The lease carries a nominal rental and a 25-per cent royalty on the gross output of gold.

The mine owners of Amador County have filed vigorous protests against the curtailment of electric power by the Pacific Gas & Electric Co. The delivery of power to the mines has been cut one-half and the companies forced to work with only night shifts. The action of the power company means a serious curtailment of gold production and increases the cost per ton of ore mined.

Marysville—Ten dredges are operating in the Yuba River field. They are owned by the Yuba Consolidated and

the Marysville companies and represent an investment of over two million dollars.

Grass Valley—The Alta-California company, operating in the Rough and Ready district about four miles below Grass Valley, has reported the discovery of the once famous Alta gravel channel. It is stated that the opposite rim of the channel remains untouched, although drifts have advanced 130 ft. from the point where the first rim was cut.

Alleghany—An option has been taken by the Alleghany Mining Co. on the bond held on the Gold Canyon group by W. H. Griffith. The shaft below the tunnel has been dewatered and preparations are being made to deepen it by sinking several hundred feet below the present point.

The Belmont property will install a small quartz mill soon. The vein is 12 to 18 in. wide, and considerable tonnage is in sight. The ore contains much free gold.

Portola—The Walker Mining Co., controlled by Anaconda, has under way a number of improvements which will materially cut production costs. The new tramway connecting the company's mill with Spring Garden, a station on the Western Pacific, will be completed in August and will do away with hauling concentrates and ore over almost impassable roads. The mill is 6,085 ft. high, Spring Garden 3,970, and the high point where the tramway goes over the mountain is 7,460 ft. Electric haulage is also being installed in the lower tunnel, bigger bunk- and cookhouses and homes for married employees are being built. A large tailings dam is being constructed. The company's saw mill is running steadily and over 200 men are employed on all operations. Complete details regarding the new tramway have already been published in a previous issue of the *Engineering and Mining Journal.*

The mine is opened up on three levels from the shaft, the deepest being 380 ft., but it is planned to do most of the future work through the tunnel that gains a depth on the vein of 1,000 ft. below the collar. The values on the tunnel level are about the same as on the 380. The orebody has been proved for 1,100 ft. north of the shaft and 1,600 ft. south. The tunnel is in about 4,750 ft. and a raise is being put up to connect with the fourth level. After this connection is made all ore will be dropped through the raise and run to the mill at the portal of the tunnel. Although a large tonnage has been developed in the mine workings and by diamond drilling, the vein has not been prospected southeast of the point where it was cut by the tunnel.

The Walker company's flotation mill is treating an average of 200 tons per day, but with improvements under way it is expected to handle about 275 tons daily. A high recovery is being made. V. A. Hart has directed operations since the Walker was first taken under option by Anaconda.

COLORADO

Smuggler-Union's Flotation Capacity Temporarily 400 Tons Per Day—Royal Tiger Mill Running

Ophir Loop—The Silver Bell property has been reopened and development work is being done under contract on two levels. Frank E. Trumble is manager.

Telluride—The Smuggler Union is installing enough flotation units to take care of 400 tons of ore per day. This will be the temporary capacity of the plant until additional equipment is delivered. The new office building, replacing the one recently destroyed by fire, is completed and in use.

Eldora—The Consolidated Leasing Co. has completed its mill, which will soon be running two shifts. C. E. Kahler is president and general manager.

Breckenridge—The Germania property on Little Mountain is being developed by lessees. Ore carrying 1 oz. gold per ton and some silver has been opened. Three carloads have been shipped recently to the Arkansas Valley smelter at Leadville.

The Missouri property on Shock Hill is being developed by George Robinson and associates. An electric hoist has been installed and shaft sinking resumed. The shaft will be sunk to the blanket vein of lead "sand carbonate" ore, which has been opened in the neighboring Iron Mask mine at a depth of 175 ft.

The Iron Mask is being operated under lease by Ostrom & Tillett. Raises from the main tunnel have opened a shoot of lead carbonate ore. The ore produced is being held temporarily in the hope that the silver market will improve. The pumps are handling about 500 gal. per min.

The Jessie property is being developed under the management of George Roth, with J. C. Warnecke as mine superintendent. Zinc-lead ore, carrying gold and silver, has been opened, and the concentration and amalgamation mill is in operation, with 20 of the 40 stamps dropping. The lead-zinc concentrate is shipped to Denver.

Tiger—The Royal Tiger property is being developed under the management of John A. Traylor. Several new buildings have been erected recently, and the small concentrating mill is in operation. The company has purchased the Cashier property, and a crosscut is being driven to cut the Cashier vein at a point several hundred feet below the old workings.

Idaho Springs—The Gem Mining Co. now owns the Gem Mines, the Freighters Friend property, the Newton mill, and the Gem electric plant and steam power plant. The Franklin Mines and the Silver Age Mines, owned by the Consolidated Franklin Mines Co., together with the Gem properties, will be operated by the Gem Mining Co., financed by a new syndicate, with the following officers: W. E. Renshaw, president; Sir Henry M. Pellett, chairman of the board; R. B. Lamb, consulting engineer; B. W. W. McDougall, general superintendent; and George C. Cochrane, mine superintendent. Capital has been provided for extensive development. The Gem shaft is being retimbered preparatory to resuming active operations.

Boulder—The Tungsten Products Co. is erecting a plant for treating radium ores from its property at Gateway, Col.

Rico—Shipments from the Rico Wellington have been resumed, two cars of $40 ore going out every thirty days. The ore is coming from the body found early this year. Shipments were suspended temporarily when the railroad was washed out.

IDAHO

Omaha Co.'s Compressor Plant Burned—Sabina Mines Co. Reorganized—Big Creek Building Long Flume

Wallace—Lightning struck the compressor building of the Omaha Mining Co. during a storm on July 18 and was followed by a fire which destroyed the building which contained the dry room and blacksmith shop, the loss being about $5,000. August Paulsen, one of the owners of the Hercules, is the owner of the Omaha. The plant will be rebuilt at once.

The Sabina Mines Co. is the name of a new corporation which succeeds the Sabina Mining & Milling Co. Certain shares of the old company were issued under agreement that they should be non-assessable and a test case in the district court sustained the agreement. The company being confronted with the necessity of levying assessments as the only means of providing funds for performing annual assessment work on eleven claims and otherwise developing the property, decided by a vote of stockholders representing more than two-thirds of the issued stock to organize a new company on an assessable basis which has taken over the entire holdings of the old. The party holding the non-assessable stock protested against the action and is expected to appeal to the court again.

The Big Creek Mining Co., which has been enjoined from discharging water containing slime and tailings from its mill into the creek from which the people of Kellogg receive their domestic supply of water, is building a flume that will convey all water and tailings from the mill to a point sufficiently removed from the creek to prevent anything foul reaching it. The injunction was issued by the district court upon application of the city of Kellogg and the Kellogg Power & Water Co.

The problem of separating the lead and zinc in the ores of the Coeur d'Alene district of Idaho and of making a closer recovery of both minerals has for over two years engaged the attention of the experiment station of the bureau of mines maintained in connec-

tion with the University of Idaho at Moscow. Much progress has been made in solving the problem in the laboratory and the process evolved is now being given practical tests in the mills of the Coeur d'Alene district under the personal direction of A. W. Fahrenwald, superintendent of the Moscow station.

The results of practical demonstration have so far proved satisfactory upon the same character of ore as that used in the laboratory tests, but as the lead-zinc ores differ in the various mines of the district and even in the same mine, much experimental work remains to be done to adapt the process to the varying conditions. However, the main problem seems to have been solved, and there appears to be little doubt but that the process can be adapted to the various classes of lead-zinc ores.

Mr. Fahrenwald has devised a flotation machine which has been in successful use in making laboratory tests in flotation. He will give practical demonstrations of the machine in connection with the present work in this district.

MINNESOTA

Mesabi Range

Assessed Valuations Increased in Chisholm District—Oliver Iron Building Houses at Leonidas Mine

Hibbing—Mahoning Ore & Steel Co. is conducting stripping operations along the north bank of the Mahoning pit using the new all-steel 30-yd. dump cars. The Oliver company has made the first shipment from the new Sweeny mine, an underground property with an estimated tonnage of 1,846,000 tons mixed bessemer and non-bessemer.

The office of the State Auditor announces that shipments from state mines this year will probably exceed those of last year. To July 17 the total shipments were 2,144,002 tons, of which 1,017,360 tons was shipped from the Missabe Mountain pit at Virginia.

Chisholm—The assessed valuation of mining property of the Oliver Iron Mining Co., in this district has been increased $7,400,000 by the local board of equalization. Increases were made in personal property amounting to $640,000 the principal items covered being location houses, warehouse supplies and mining timber. Increased valuations of stockpiles amounted to $1,500,000, the rest covering unmined ore. Other mining interests in the district have fared proportionately. It is understood that the local board is encroaching on the jurisdiction of the state tax commission and that the matter will be carried before that body.

The new Wellington shaft of the Oliver company is bottomed at 208 ft. The station for the main level has been cut at 170 ft.

Buhl—A factory expert has arrived at Buhl to take charge of erecting the new 300-ton electric shovel to be used in stripping the Wabigon mine of the Hanna Ore Mining Co. The base of the shovel has arrived and the rest is en route.

Shipments have started from the stockpile of the Frantz mine.

The Fort Henry Mining Co. is sinking an auxiliary timbered shaft at the Woodbridge mine.

Eveleth — The Oliver company is breaking ground at the Leonidas mine for 25 new houses, which have been planned for some time. One duplex, one triplex and 23 four-, five- and six-room dwellings are included. It is expected that many will be ready by winter.

Cuyuna Range

Trommald — The surface equipment and buildings of the Ferro mine of the Onahman Iron Co., at Trommald, were brought at the sheriff's sale on July 10 by the Gorham-Garbett Co., of Minneapolis, for $15,156.86. The latter company owns the fee of the property and was the only bidder.

Crosby — Shipping from the stockpile of the Croft, a John A. Savage property at Crosby, has been started and is proceeding at the rate of 60 cars per day.

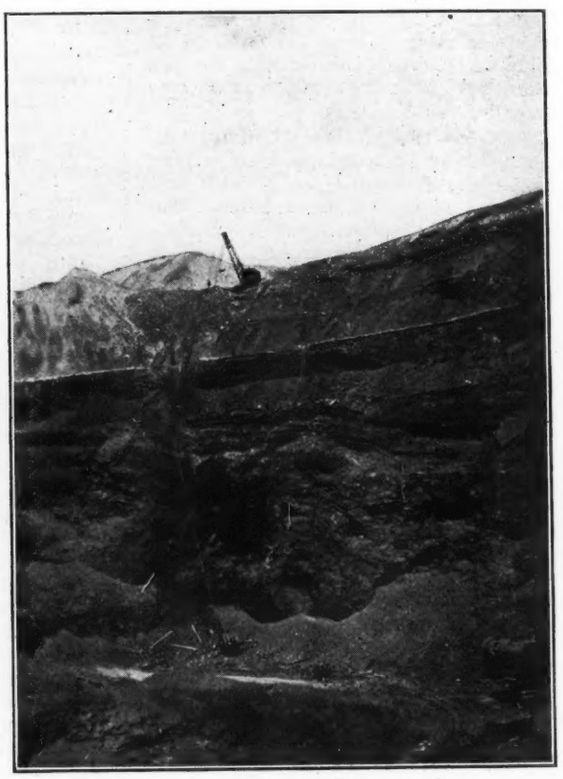
Superior — It is reported that the Soo line is planning the construction of a steel and concrete ore dock at Superior to handle Cuyuna Range shipments and to replace the wooden dock now in use.

The Ida Mae mine of the Cuyuna-Minneapolis Iron Co. pulled its pumps on July 17, and allowed the mine to fill with water. This property was opened by the Merritt interests during the war, and had just started production when the armistice was signed. It remained closed during the winter of 1918-1919, and was opened last summer, a reorganization of the company's finances having been effected. Development on a small scale was carried on through the winter, but nothing but pumping has been done since March. The mine has a stockpile of about 18,000 tons of a good grade of manganiferous iron ore, low in manganese and silica. Inability to sell the product is given as a reason for the shutdown.

MISSOURI

St. Joseph Lead Co. Buys Jake Day Tract—American Metal May Re-enter St. Francois County

Leadwood—The Jake Day tract, near Leadwood, in St. Francois County, has been sold by the Baker Lead Co., of Boston, to the St. Joseph Lead Co. This property contains 357 acres, and was purchased ten years ago by the Boston interests for $357,000, or at the rate of $1,000 per acre, which at that time was regarded as a good price for a tract that had been repeatedly diamond drilled by all the large companies in the district and turned down every time. The first time the property was taken under option and drilled by the St. Joseph company, about 25 years ago, the price was only $100 per acre. The Baker company sunk one shaft on the tract on the edge of Big River that was about 400 ft. deep, but were not financially able to build a mill. From 300 to 500 tons of ore was mined daily for several years, and was hauled 12 miles over the M. R. & B. T. R.R. at an expense of 25c. per ton to the mill of the National Lead Co., where it was milled for 75c. per ton. The ore ran 7 to 10 per cent in lead by actual sampling and assay, under selection, and was decidedly profitable, in spite of this excessive burden of $1 per ton for milling and freight.



LOWERING HEAVY MACHINERY INTO SHENANGO PIT, CHISHOLM, MINN., TO BE USED IN CLEANING UP ORE

The St. Joseph Lead Co. has surrendered its option on the tract it recently drilled in Crawford County and has shipped its drills to Bonne Terre.

Interests connected with the American Metal Co. are examining several tracts in St. Francois County, as they desire to re-enter this district, where they formerly owned the Columbia property, which they later sold to the Doe Run company.

Pottersville — The discovery is reported of zinc ore of good grade on the farm of J. D. Ellison at Pottersville.

MONTANA

Anaconda Considering Doubling Capacity of Rod and Wire Plant—Potomac Mines To Have Rail Facilities

Butte—A program for doubling the capacity of the rod and wire plant at Great Falls, Mont., is said to be receiving consideration by Anaconda officials. This department has proved particularly profitable in the last two years and has been operated practically at capacity. Headway is being made in connection with the company's plans for working phosphate ground near Soda Springs, Idaho.

A second vein has been opened by the Davis-Daly on the 2,700-ft. level of the Colorado mine showing, it is said, 9 ft. of 6 per cent ore. It is believed to be a branch vein and not the No. 2 fissure, the objective of the cross cut on this level.

Sinking is progressing at a good rate at the Plutus shaft of the Butte & Plutus company, with three shifts at work.

Production has been maintained by North Butte at about the rate of about 2,000,000 lb. of copper per month since July 1, which shows practically full recovery from the effects of the I. W. W. strike in April.

Barnes-King's oil-drilling operations at the Kansas-Montana well in the Winifred district, in which the company is interested, are being delayed by a buckle in the casing. Bullion production for June decreased from that of May.

Shaft sinking has been started by the Roberts Minerals Co. on the Roberts claim, 3½ miles north-east of Butte and is down about 35 ft.

Electric power has been installed at the Honolulu and driving of the tunnel will be resumed. About two feet of ore has been cut.

Six mines only still hold a 100-per cent record in the Safety-First contest being held in the Butte district. An "ax-i-dent" meter daily registers the mines which have been free from accidents of any character.

Potomac District—It has been announced by the C. M. & St. P. that it will construct a line from Black Foot to Clearwater. This will bring the Potomac mines close to rail facilities which have been sadly lacking. Crosscutting for the Leonard veins and the Copper Cliff is still in progress.

Elkhorn—At the Boston & Montana the drift is now in the Blue Jay vein for nearly 500 ft. with milling ore continuing all the way and showing a width of more than 6 ft. Further development on the 1,000 level of the Idanha has been suspended. Ballasting of the Montana Southern railway has been completed.

Neihart—The state has instituted suit to prevent the Cascade company from dumping the tailings from its concentrator into a nearby stream on the grounds that it pollutes the water, killing fish and fouling the water.

NEVADA

Round Mountain Company Not To Close Down—Arrowhead Consolidated Pushing Development

Tonopah—Bullion shipments to date indicate a gross production of the district for July of about $500,000. Labor conditions are fair but there is still a shortage of steady men in the camp. The supply of men is adequate to operate all mines to capacity but the condition exists of intermittent working, which is probably due to the prevailing high wages of the district.

The Tonopah Extension company is making fair headway in sinking the Victor shaft from the 1,760 to the 1,880 level. The flow of water impedes operations to a certain extent but pumping equipment is adequate to handle even an increased flow of water. Cleaning up the old workings from the bottom level of the McCane shaft is progressing and it is hoped that within a short time actual development work can be started from this shaft. Tonnage for the last week was 1,550 tons. Development and stoping were satisfactory on the Murray and Merger veins from the 1,350, 1,540, 1,680, and 1,760 levels; and some ore was stoped from the Lower Contact vein.

The Tonopah Mining Co. reports no new developments of importance, tonnage of ore mined being normal and developments satisfactory. This company is making a determined effort to acquire new and promising prospects and is doing preliminary work on several prospects throughout the state.

Development by the West End company on the West End, Ohio and Footwall veins continues favorable, and the mill is operating to capacity on West End, Jim Butler Lease, and Halifax ore. Shipments from the West End mine totaled 1,300 tons for last week. The profit for June is announced as $43,124.42, from 4,425 tons of mine ore and 534 tons of Jim Butler lease ore. Prospecting in the Tonopah "76" ground, being done by the West End company under agreement with the "76" company, from the 800 level of the Ohio shaft, continues in favorable formation. Progress in "76" ground for June is given as 114 ft.

The Belmont tonnage is normal and development continues to prove large tonnage of mill ore both in the vicinity of old stopes, in hanging and foot-wall of the veins, and in new blocks. Narrow veins furnish grade and mine conditions are good. Bullion shipments for the first half of July are given as $83,600.

OLD SURFACE PLANT OF TONOPAH MINING CO. OF NEVADA, TONOPAH, NEV.

Divide—In the Tonopah Divide mine regular development is under way on the 1st, 3rd and 5th levels, with shaft sinking making good progress. Developments are encouraging and it is stated that the major portion of the 30 tons per day being shipped to the MacNamara mill in Tonopah is coming from development. Many smaller companies in both the Divide and West Divide districts are operating with no new strikes of importance reported.

Arrowhead—Crosscutting on the 300 level of the Arrowhead mine is being done and it is reported unofficially that ore of good grade has been encountered. Details are lacking. Favorable developments are reported in the Arrowhead Consolidated and work is being vigorously prosecuted.

Round Mountain—In spite of rumors to the contrary it has been officially announced that the Round Mountain Mining Co., operating at Round Mountain, has no intention of closing down its hydraulic and lode mines. The hydraulic season is over for this year and

gravel worked this season averaged about $1 per yd., the scale of operation having been about the same as in the previous year. Preparations are being made for impounding more surplus water which will mean a longer period of hydraulic operation during the coming year. The company has plenty of proved ground available for several years, with large areas not yet drilled.

The lode mine is being worked on a small scale only, selective mining being followed. It was not deemed possible to mine a large tonnage of the low-grade ore at a profit under existing conditions, so no increase in tonnage is anticipated at the present time. Gold is the major product, and like all gold mines this property is handicapped by the increased cost of production without a compensating increase in the price of its product. Relief by Governmental action has not yet materialized.

Rand District—There is considerable activity in the Rand district, formerly known as Bovard in the days of the Rawhide boom. For two months the Gold Pen Mines Co. has been operating a Kincaid mill, with a Senn pan amalgamator, treating 10 tons every 24 hours. The water for the mill is hauled 8 miles in trucks, 100 gal. per ton of ore being required. The mine is developed to the 250 level, and there is said to be a good tonnage of mill ore in sight in addition to the higher grade now being treated.

Hughes & Crabtree have made a promising find midway between the Gold Pen and the Walker Bros. ground. Eight feet on the surface averages $6.50 per ton.

Yerington—A transmission line from the high-tension line between the Bluestone mine and the Thompson smelter is being put in by the Walker River Copper Co. to its property opposite Yerington. The company has just completed a 50-ton experimental plant but will have enough power to operate the larger mill that it expects to erect eventually, as well as for more equipment at the mine.

Talapoosa—The camp at the Talapoosa is being moved to a point close to the main workings. It is planned to sink an old prospect shaft, now down 60 ft., to a depth of 300 and then crosscut to prospect the ground thoroughly on this level.

Barcelona — Work has been suspended at the Cons. Spanish Belt mine at Barcelona, near Manhattan, until the power transmission line to the property is completed, which will be several weeks. Hand work was proving too costly, according to the management. E. J. Schrader, superintendent, is now in the East.

Mina—A body of silver-lead-zinc ore has been drifted on for more than 50 ft. on the 350-ft. level of the Simon Contact property.

Contractors sinking the shaft on the Fagan Consolidated an additional 200 ft. have completed the first 100 ft. of the work.

NEW MEXICO

Manganese Mining Active in Little Floridas—Romaho Co. Installing Diesel Engine

Deming—There is considerable activity in the manganese field about 14 miles southeast in the Little Florida Mountains. The Humphreys lease on the Warren-Hoagland property, in charge of C. B. Allen, is working 15 men. The ground is opened in fair shape for production. One shaft, 100 ft. deep, three tunnels, 120, 100 and 40 ft. respectively, and a number of shallow pits, all of which show ore, constitute the development. An average of this ore shows 47.80 per cent Mn and 2.50 per cent SiO_2.

The Wayne Whitehill property, which is undoubtedly an extension of one of the Warren veins, shows about 4 ft. in width of solid ore. The opening is about 20 ft. long but of shallow depth. The Jim Finch property has an inclined shaft down about 40 ft., showing about 2 ft. of good ore. About a half car of sorted ore is on the dump at present. W. J. Summerville of El Paso has recently purchased a half interest in this property.

The New Mexico Metals Exploitation Co., of Santa Rita, N. M., has started to open up what seems to be the northeastern extension of the McClure & Hoagland manganese claims, high up on the easterly side of the Little Floridas. Superintendent Davis reports a 2½-ft. vein of high-grade ore showing upon the surface and traceable for three chains in length.

The ores from this district are shipped from Mesie station on the main line of the Southern Pacific, where the ore loading platform has been enlarged to take care of this tonnage. The distance is about 6 miles with good roads.

Gage—The Victor Mining & Smelting Co. has made a new strike of good lead-silver ore on the Wyman-Corbett property, which it is working under a lease and bond. This is one of the old Haggin & Hearst properties worked extensively during the '80s. Dr. Duryea and associates of New York are the principal stockholders. Norman T. Welch is superintendent.

The Gage Mining Co. has given up its lease on the old W. L. Bradley property and will retire from the district.

Columbus—The Romaho Mining Co. will finish timbering the Waterloo shaft to the 100-ft. level by August 7. A 50-hp. hoist is being installed and a 500-cu. ft. compressor will be purchased at once. A 50-hp. Diesel engine is now at Columbus ready to be hauled to the property.

OREGON

War Eagle Company To Erect 30-Ton Mercury Furnace

Gold Hill—The War Eagle Mining Co., of Medford, Ore., with the Utah group of quicksilver mines, 12 miles north of Gold Hill, has let a contract to W. H. Stickel, of Gold Hill, to burn 300,000 brick at the mines to be used in constructing a 30-ton Scott mercury furnace. The company has also acquired a right from the state to take two second feet of water from Morrison Creek, which will require two miles of 8-in. pipe, to be constructed by Oct. 1.

It is reported that the Chisholm group, adjoining the Utah group, will soon change hands and that a Scott furnace will be erected. This property is equipped with a pipe-type furnace, and has been worked in a crude way since 1878.

The Force group, adjoining, which is also equipped with the pipe-type furnace, has developed sufficient ore to justify a furnace of larger capacity. These properties have been operating only on cinnabar ore running better than 15 per cent mercury and dumping lower grade for future reduction.

UTAH

A. S. & R. Loses Sample Mill at Murray by Fire—Tintic Delaware Wins Suit Against S. L. F. & K. Railroad

Bingham Canyon—The Utah-Apex is successfully using the contract system in working some of its orebodies. The men are paid for the amount of work done, receiving from the company all necessary materials, power and powder. There are 285 men working at the property.

The old New England mine, owned by the Utah-Boston Development Co., is being reopened. It is said that the shaft is to be deepened from the 300 to the 800 level.

It is reported that the Montana-Bingham workings are to be connected with the Mascotte tunnel of the Ohio Copper for better transportation. Ore shipped recently is stated to have run 6 per cent copper; 2 to 6 oz. silver; and $1.50 in gold.

Murray—The destruction by fire of sampling mill No. 4 of the American Smelting & Refining Co. at Murray occurred early on the morning of July 27. The loss is estimated at $50,000. This mill built twelve years ago was the last in a series of four, and especially equipped.

Alta—The recent strike at the South Hecla is producing about half of the daily output of one car of ore. The new ore occurs about 700 ft. below the deepest workings of the old Rustler mine, and is believed to be the downward extension of the Rustler orebody.

Active work is being done at the Woodlawn property in Big Cottonwood Cañon, at which ore has been opened on the 100-ft. level in three places. The present average width of the shipping ore is given as 2 ft. The Columbus-Rexall at Alta in Little Cottonwood reports a large amount of shipping ore in sight.

American Fork—The tunnel of the American Consolidated, which has taken over the Bog and adjoining properties, is in 1,800 feet.

Park City—Shipments for the week ended July 24 amounted to 2,349 tons as compared with 2,267 tons the week

preceding. Again the Ontario, with 911 tons, was the heaviest shipper.

The Silver King Coalition followed with 645 tons.

The Ontario Silver Mining and London Guarantee Co. has been directed by the state industrial commission to pay Laura Cox for herself and for Laura Cox, a minor, $2,160 at the rate of $16 weekly for 135 weeks, to begin from April 27, 1920, and also to pay W. D. Richards, undertaker at Park City $150 for funeral expenses on account of the death of Stanley Cox, killed at the mine April 27.

Milford—There is renewed activity at a number of mines in this district. The Wild Bill, adjoining the Cedar Talisman, is being operated by lessees, who are making shipments. One car shipped recently is stated to have netted $4,000. It was the sixth car of high-grade shipped within three months. The ore was opened from a winze sunk from the bottom of an inclined shaft driven under by the company. There is no power equipment at the property, all work accomplished so far having been done by hand.

The lower tunnel of the Monitor, which is being driven to cut a north-south fissure productive in upper workings, is within 40 ft. of its objective. A thin sheet of ore is present in places in the tunnel roof, and where cut has proved to be 6 to 12 in. thick. The ore is lead-silver of high-grade.

The old Humboldt group is to be reopened by men interested in the Capital company. Equipment has been installed and shaft sinking started.

Eureka—Tintic shipments for the week ended July 24 amounted to 145 cars.

The Tintic Delaware in west Tintic has won a suit against the Salt Lake Fillmore & Kanosh railroad et al., to recover $5,000 and interest on money alleged to have been advanced to representatives of the railroad for building a railroad from the Salt Lake route in Millard County to the Deseret Mountain mine and other properties in the west Tintic district. The verdict is for $4,800 and interest at 8 per cent per annum from July 9, 1918, together with costs of the court. G. W. Craig, president of the company and Alva Craig Nelson, secretary, are held responsible under the decision.

The Tintic Milling will have a car of bullion ready for the market early in August.

The Eagle & Blue Bell is producing about 150 tons of ore daily. Drifting is being done on the 2,000 level, the lowest level, where work was discontinued for a time owing to labor shortage. Much development is being done, especially on the 1,500 and 1,800 levels.

Oakley, Idaho—The Vipont Silver Mining Co., situated in Utah near the Utah-Idaho line, is stated to be treating an average of 130 tons of silver ore in its mill, and shipping concentrates. The Idaho-Utah in this neighborhood is stated to show promise.

WASHINGTON

Northwest Magnesite Co. Operating at Full Capacity—Heavy Demand Reported for Calcined Product

Chewelah—The Northwest Magnesite Co. is producing upward of 300 tons of calcined magnesite daily. It has 3,000 tons ready for shipment. Consumers are offering a bonus of $4 a ton for immediate delivery and will accept shipments arriving in uncovered cars, a situation unprecedented owing to the loss from slacking sometimes suffered from moisture entering unprotected cars. The current price for magnesite at Chewelah is $28.50 a ton. The company is operating five steel kilns, each 136 ft. long. Its tramway brings 620 tons of crude magnesite daily from its quarries, which are working on two shifts. The kilns and tramway are operated continuously. Calcining reduces the weight of the magnesite by 50 per cent. Three hundred men are employed in all.

Invermere—The Silver King property, operated by the Toby Creek Mining Co., Ltd., of Vancouver, B. C., and near the Jumbo fork of Toby Creek, is showing up extremely well. At about 90 ft. from the surface a cross-cut is being driven to the hanging wall of the vein south of the tunnel. This has opened up a ledge about 80 ft. wide of silver-lead ore, running high in silver. There is considerable shipping ore already on the dump. A road is under construction.

Hedley—There now are employed at the Nickle Plate mine, Hedley, B. C., about 150 men, two-thirds of whom are underground and the rest at the mill and power plant. The company is mining $9 gold ore. As it costs about $8.50 a ton to mine, the profits are negligible.

SILVER KING CONSOLIDATED MINING CO.'S MILL ON CALIFORNIA-COMSTOCK SECTION OF PROPERTY, AT HEAD OF THANE'S CANYON, PARK CITY DISTRICT, UTAH

CANADA

Nickel Plate Working $9 Ore at $8.50 Cost—O. B. U. Demands Increase at Blue Bell

Stewart—The season's work has been well under way in the Portland Canal district for several weeks. With the snow gone and the prospectors and miners in the hills, the towns of Stewart and Hyder are almost deserted. On the various properties along the Salmon and the Bear rivers, however, activity prevails. The only notable new discovery reported is on the Georgia River, a few miles down the river from Stewart, where a number of promising gold-bearing claims have been recorded. The Marmot River is also being well prospected and many claims have been located. For the rest, development is continuing on all the better known mines and prospects of the Portland Canal, and road construction is in progress. The Unicorn Group is to be drilled, a contract having been awarded to Lynch Bros., of Seattle, Wash., and F. P. Stewart, familiarly known as "Pap," has returned to the camp to supervise plans for opening up the Mountain Boy group of crown-granted claims. "Pap" is a pioneer of the Portland Canal District, being credited with having directed the attention of Sir Donald Mann to the potentialities of the district.

Nelson—The Blue Bell mine at Riondel, B. C., is the latest property to come under the interdiction of the One Big Union. This organization has demanded for the workers in that mine a scale of wages which, it is said, amounts to an increase of 40 cents per day over what was being paid. The Blue Bell is the oldest mine in the Kootenays, dating back to 1865, and is operated by the New Canadian Metal Co.

Salmo—Nugget Gold Mines, Ltd., is milling about 40 tons of ore daily which will continue until development is further advanced. The tails are running about 21c. a ton, the feed carrying $10 to $18 gold per ton. The mill is equipped to cyanide 150 tons daily. Considerable development is planned in the hope that richer ore will be found. Ore is being mined on several levels, the upper one being 600 ft. below the surface and the lower 1,000 ft. Two-ton cars run on a narrow-gage electric railway for a mile out of the mine. The ore is then dumped into a tipple at the top of a steep side hill. From here it goes in cars to the mill.

Trail—Ore shipments received at the Consolidated M. & S. Co.'s smelter at Trail, during the week ended July 21, were as follows:

Mine	Location	Gross Tons
Bluebell,	Riondel	69
Emerald,	Salmo	33
Florence,	Princess Creek	66
Mandy,	Le Pas, Man.	313
North Star,	Kimberley	78
Silver Bear,	Kaslo	28
Velvet,	Rossland	30
Company mines		6,444
Total		7,061

Victoria—Although no extensive development of the magnesite of British Columbia has taken place as yet, there are a number of large and noteworthy deposits. One of the most important is that situated near Atlin, in the northern section of the province. A few hundred tons of hydro-magnesite has been shipped from this point, but the freight charges have proved a handicap. The unusual purity of the magnesite in question, however, may permit its use for special high-priced work.

G. A. Young, of the Geological Survey of Canada, estimates that, within the various blocks, there are at present at least 150,000 tons of this hydro-magnesite which could be worked with the expectation of obtaining a product carrying between 41 per cent and 42 per cent MgO with about 3 per cent lime, iron oxide, alumina and silica. The thickness of the deposit is from 2 to 3 ft. The analyses show the material to contain about 2 per cent water that could be removed by drying and about 20 per cent combined water which could be driven off by roasting or calcining. Owing to transportation costs, it is considered desirable that the material be calcined before shipping. The material occurs in the form of a very fine powder when dried.

There are several magnesite properties in the central interior of the province, north of Ashcroft, none of which has been developed extensively, but there is no doubt that the deposits are large. The magnesite properties of this district have been described with analyses in the *Canadian Chemical Journal*, published 72 Queen Street West, Toronto, June and July, 1919, by L. Reinecke, of the Geological Survey.

The latest step taken by William Sloan, minister of mines, toward the acquirement of information bearing on the possibilities of the establishment of an iron and steel industry in British Columbia is the appointment of F. J. Crossland, of Vancouver, B. C., consulting mining engineer and geologist, to carry out a thorough inspection of the hematite and limonite ore deposits of the Clinton Mining Division situated in the Whitewater River region and to establish, as far as possible in one season's work, the tonnage of this mineral available.

At the last session of the Provincial Legislature, Mr. Sloan spoke of the possibilities of private enterprise or the government giving consideration to the taking of initial steps toward launching this industry. He spoke of a report received from William M. Brewer, government mining engineer, who made an examination of the deposits last year and was favorably impressed, figuring from an examination, necessarily superficial because of the limited time at his disposal, that there was a possible 50,000,000-ton deposit of limonite of good quality, eminently suitable for fluxing with the magnetite ores of the Coast in the production of pig iron by blast furnace, and so situated as to be easily mined. Mr. Sloan then stated that it was his intention to have the district well explored, and his engagement of Mr. Crossland is in line with that undertaking.

It is pointed out, in this connection, that the Provincial Government work is to be supplemented by that of the Geological Survey Branch, Department of Mines, Ottawa, which will have two parties in the field. One of these, under J. D. MacKenzie, will make a geological survey of the Taseko (Whitewater) Lake area and the other, under C. H. Freeman, will conduct a topographical survey.

As an instance of the utility of the amendment to the mineral act introduced by the Minister of Mines at the last session of the legislature, it is announced, coincidentally with Mr. Crossland's appointment, that a reserve has been declared on the drainage area of the Taseko (Whitewater) Lake, Chilko Lake, Tsuniah, Choilquoit, and the Chilko River and Big Creek, Clinton Mining Division. This reserve takes effect on the first of June. Claims already recorded will not be interfered with, as provided by the terms of the act, but all open iron properties, within the limits defined, will be held by the Crown until it is determined how far they need be used for the encouragement of the industry.

On the general question of the production of iron and steel from the iron ores of British Columbia, Mr. Sloan expresses the opinion that conditions were never more favorable for the successful establishment and maintenance of the necessary plant. If the limonite deposits of the Whitewater country turn out to be what reports appear to indicate, he says, there will be no problem to hinder the handling of the magnetite ores by blast furnace. The economic possibilities of the electro-thermic principle, however, are not being overlooked.

Ontario

Porcupine—Vein No. 5 of the McIntyre which has been opened up at the 1,125-ft. level is from 9 to 10 ft. wide and is said to average $18 gold per ton. It has been opened for nearly a quarter of a mile and found to extend into the Jupiter claim.

The shareholders of the Porcupine Vipond-North-Thompson on July 27 ratified the proposal to sell 600,000 shares of treasury stock to a syndicate in which English interests are prominent. Immediate delivery is to be made of 200,200 shares at 15c. with an option of 200,000 more at 30c. for six months; and a further option on another 200,000 shares for ten months at 50c. This transaction will secure funds for the re-opening of the mine.

The option that has been held by the Dome Mines on the Dome Extension expires Sept. 15 and whether it will be exercised or allowed to lapse is believed to be largely dependent on the result of operations now being carried on at the tenth level. A large orebody at a vertical depth of 1,150 ft. at the boundary line of the two properties, having a dip into the Dome Extension, has been indicated by diamond drilling. The core from the diamond drill hole was officially stated to show a gold content of $7.94 per ton for a distance of 93 ft., and $5.16 for an additional distance of 23 ft. The present work is being undertaken to verify these results. The orebody on the 850-ft. level of the Dome Mines shows a width of 43½ ft. and carries an average of about $7.60 to the ton, with an ore shoot stated to show much greater enrichment.

Kirkland Lake—Good progress is being made with the construction of the Wright-Hargreaves mill. The structure is almost completed and the mechanical equipment is in process of installation. Two crushers, a ball mill and two tube mills are in position.

The Orr Company has purchased the assets of the Kirkland Porphyry mines, which recently went into voluntary liquidation. Mining operations will be resumed immediately.

The Kirkland Combined mines has resumed work using the Sylvanite plant. The shaft is down 200 ft.

The Lake Shore Mines, Limited, during June recovered $37,546 from the treatment of 1,535 tons of ore, being an average of $24.46 per ton. The output for the first six months of the year was $244,710.

The shaft on the Kirkland Lake is down 900 ft., being 300 ft. lower than any other working in the camp. During the first four months of the year the total production was $107,700, the mill running at about two-thirds capacity and treating approximately 100 tons per day.

Cobalt—The Temiskaming has installed an oil flotation plant of the Callow type which is expected to be in operation about the middle of August.

At the Crown Reserve gold has been encountered at a depth of about 800 ft. occuring in the quartz. Assays are said to show $12 to the ton.

Sudbury—A large number of farmers in the neighborhood have brought actions against the International Nickel Co. claiming damage for injury to their farms from sulphur fumes.

West Shining Tree—The Wasapika Gold Mines proposes to sell part of 2,000,000 treasury shares at 10c. The capital of the company is $6,000,000.

THE MARKET REPORT

Published in part in San Francisco and mailed from there to our Western subscribers as a special service without charge pending the arrival of the *Engineering and Mining Journal*

Daily Prices of Metals in New York

July	Copper	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
29	18.50	44.75	48.00@48.50	8.60	8.25@8.75	7.65@7.70
30	18.50	44.75	48.00@48.50	8.60	8.25@8.75	7.65@7.70
31	18.50	44.75	48.00@48.50	8.60	8.25@8.75	7.60@7.65
Aug.2	18.35@18.50	44.75	48.00@48.50	8.60	8.25@8.75	7.55@7.60
3	18.35@18.50	45.00	48.25@48.50	8.60	8.25@8.75	7.55@7.60
4	18.25@18.50	44.00	47.50@47.75	8.60	8.25@8.75	7.50@7.55

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point. All prices are in cents per pound.

Copper is commonly sold on terms "delivered," which means that the seller pays the freight from refinery to buyer's destination. The delivery cost varies, and it would be confusing to figure net prices on individual transactions. Consequently, an average deduction is made from the "delivered" price. At present the average cost of delivery from New York refineries is 0.15c. per lb., and that deduction is made to arrive at the New York price. When copper is sold f.o.b. or f.a.s. New York, of course no deduction is made.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

July	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
29	90⅜	93¼	110	265	270	36⅜	36⅝	41	42⅜
30	92¼	94½	110	268¼	273¼	37¼	37½	41¼	42⅜
31	....	....	...	....	....	...	...	...	...
Aug. 2	....	....	...	....	....	...	...	...	...
3	92½	94¾	111	273	278	37¾	38	41½	43
4	94¾	96¾	111	275¼	279¾	38⅝	38¾	42¾	44½

The above table gives the closing quotations on the London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

July	Sterling Exchange	Silver			Aug.	Sterling Exchange	Silver		
		New York, Domestic Origin	New York, Foreign Origin	London			New York, Domestic Origin	New York, Foreign Origin	London
29	374	99½	93½	56½	2	371½	99½	93⅜	...
30	370½	99½	92⅝	56¼	3	367	99½	93¾	57
31	371½	99½	93⅜	56⅝	4	355	99½	92¾	57⅛

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

On the authority of the Secretary of the Treasury, we quote 100c. per oz. for silver, 1,000 fine, delivered at the option of the Director of the Mint to the New York Assay Office or to the mints in Philadelphia, Denver, or San Francisco, and proved to the satisfaction of the Treasury Department to have been mined, smelted, and refined in the United States. This quotation is retroactive to May 13.

Metal Markets

New York, Aug. 4, 1920

Inactivity still characterizes the major metal market. Buyers refuse to be interested except at cut prices. With money at the present high rates of interest, some producers are willing to shade prices, to relieve themselves of accumulating stocks of copper and zinc. Dealing in metal for forward delivery is discouraged, owing to the fact that costs will be increased on account of the recent 25 to 40 per cent increase in freight rates, yet, in the present buyers' market, no increase can be obtained.

Copper

Buyers refuse to pay the prices asked by the large producers, so that the latter's quotations are nominal. Some fairly large lots have been sold for delivery during August and September at about 18.50c. delivered. We have heard of no sales for later delivery, but it is likely that business would be refused unless a premium of ¼ to ½c. were paid. The market is decidedly weak, and improved European conditions, on which the hope of better copper prices is founded, seem even further away than ever.

Monthly Average Prices for July

Copper:	
New York Electrolytic	18.576
London Standard	90.148
London Electrolytic	106.455
Lead:	
New York	8.338
St. Louis	8.283
London	34.960
Silver:	
New York, foreign	91.971
New York, domestic	99.500
London	53.736
Sterling Exchange	385.538
Zinc:	
New York	8.070
St. Louis	7.720
London	41.886
Tin:	
99 per cent	45.798
Straits	49.154
London	261.886
Antimony	7.500
Quicksilver	90.333

Lead

No change can be reported. As high as 9c. has been paid for small lots of New York lead for September and October delivery. Larger quantities have sold for ⅛c. less, and the A. S. & R. contract price remains at 8.50c. A shipment of 250 tons of English lead on the dock here has been offered at 8.90@9c. during the week without anyone showing interest. The report of scarcity of prompt lead is almost certainly artificial, and consumers are in general well taken care of by contracts. Lead is coming out of Mexico again after a practical cessation for the last six weeks, and further English importations are unlikely. Cable manufacturers seem to be taking an interest in the market for a change.

Zinc

The dragging zinc market is largely due to the fact that galvanizers cannot get black sheets. Bad transportation conditions have limited the supply, and the steel mills can sell all they have at fancy prices to automobile manufacturers and others without galvanizing them. The galvanizers in the Pittsburgh district are operating at only 25 to 50 per cent capacity. The expected improvement in transportation conditions and the lessening activity among automobile manufacturers should help the zinc market.

Most of the metal sold last week was for nearby delivery, at decreasing prices, but forward delivery can be obtained at about the same figure.

Tin

Consumers have shown a little more interest the last day or two, but the market is dead. The unsettled foreign

exchange is a bad influence. Twenty-five tons of spot Straits was auctioned on the Metal Exchange yesterday for 47.80c.

Straits tin for future delivery: July 29th, 48@48.50c.; 30th, 48@48.50c.; 31st, 48@48.50c.; Aug. 2d, 48@48.50c.; 3d, 48.25@48.50c.; 4th, 47.50@47.75c.

Arrivals of tin in long tons: July 29th, Hongkong, 10; 30th, Rotterdam, 100. Total for July, 3,870. Aug. 2d, London, 85; Straits, 725; China, 175; Liverpool, 100; Aug. 3d, Liverpool, 25; London, 100; Straits, 425; Singapore, 275.

Silver

The trade conditions in China and India are still unsatisfactory, and much of the demand for silver is of a speculative character. Domestic demand for the arts is dull at this season of the year.

Mexican Dollars — July 29th, 71c.; 30th, 70⅞c.; 31st, 71c.; Aug. 2d, 71c.; 3d, 71⅛c.; 4th, 70⅞c.

Gold

Gold in London on July 29th, 109s. 9d.; 30th, 110s. 6d.; Aug. 3d, 112s.; 4th, 114s. 6d.

Foreign Exchange

Disturbed European conditions have caused a continued decline in exchange rates. Yesterday francs were 7.34c.; lire, 5.15c., and marks 2.19c. New York funds in Montreal, 12¾ per cent premium.

Other Metals

Aluminum—Ingot, 33c. per lb., with 32c. open market for 98@99 per cent virgin.

Antimony—Market continues weak. Spot, 7½c. per lb.; Cookson's "C" grade, 14c. Chinese and Japanese brands, 7½c. W. C. C. brand, 8½@9c. Chinese needle antimony, lump, firm at 9@10c. per lb. Standard powdered needle antimony (200 mesh), 10@12c. per lb.

Bismuth—$2.70 per lb., 500-lb. lots, and $2.72 per lb., 100-lb. lots. Market quiet.

Cadmium—Nominal, $1.40@$1.50 per lb. Market dull.

Cobalt—Metal, $3 per lb.; black oxide, $2 per lb.

Iridium—Nominal, $350 per oz. Heavy demand, but small supplies.

Magnesium—Crude, 99 per cent or over pure, $1.75 per lb., for the metal in 100 lb. lots and over, f.o.b. Niagara Falls.

[1]Molybdenum Metal in rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Ingot, 43c.; shot, 43c.; electrolytic, 45c., f.o.b. Bayonne, N. J.; Monel metal, shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—Open market, $50@$75 per troy oz.

Palladium—In sympathy with platinum jumped from $80 to $100 per oz.

Platinum—Sharp increase during the week from $80 to $105 per oz., caused by heavy demand of the jewelry trade. $95 per oz. in 100 oz. lots.

Quicksilver—Market steady; $88@$90 per 75-lb. flask. San Francisco wires $85. Unsteady.

Ruthenium—$200@$220 per troy oz.

[1]Selenium, black, powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]Thallium Metal—Ingot, 99 per cent pure, $20 per lb.

Metallic Ores

Bauxite—About 52 per cent alumina content, less than 2 per cent iron oxide, up to 20 per cent silica and artificially dried to contain not more than 4 per cent free moisture, $10 per gross ton at mine; 54 per cent alumina and about 15 per cent silica, $11; averaging 57 per cent alumina, 8 to 12 per cent silica, less than 3 per cent iron oxide, $13 on basis of 8 per cent free moisture. Ores of very low silica content suitable for the manufacture of aluminum oxide and hydrate of alumina command a fancy price.

Chrome Ore—Guaranteed 50 per cent Cr_2O_3 foreign ore with a minimum of 6 per cent silica, 80@85c. per unit, New York. California concentrates, 50 per cent Cr_2O_3 and upward, 60@65c. per unit, f.o.b. mines.

Iron Ores—Lake Superior ores, per ton, delivered at Lower Lake ports: Old Range bessemer, $7.45; Old Range non-bessemer, $6.70; Mesabi bessemer, $7.20; Mesabi non-bessemer, $6.55. Congestion at Lake Erie ports due to car shortage has resulted in decreased tonnage. Other ports show gain in shipments. Slow delivery of coal and coke to furnaces has caused operators to reduce their iron-ore requirements.

Manganese Ore — 70@80c. per unit, 50 per cent Mn content, c.i.f. Atlantic seaport; chemical ore (MnO_2) $75@$85 per gross ton.

Molybdenum—85 per cent MoS_2, 75@85c. per lb. of contained sulphide, New York.

[1]Tantalum Ore, guaranteed minimum 60 per cent tantalic acid, 65@70c. per lb. in ton lots.

Titanium Ores—Ilmenite[1], 52 per cent TiO_2, 1½@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 15c. per lb. for ore, with concessions on large lots or running contracts.

Tungsten Ore—Scheelite, 60 per cent WO_3 and over, per unit of WO_3, $7 f.o.b. mines; wolframite, 60 per cent WO_3 and over, per unit of WO_3, $6@$7, in New York.

Uranium Ore (Carnotite)—$2.75@$3 per lb. for 96 per cent of the contained oxide (U_3O_8). Ores must contain a minimum of 2 per cent U_3O_8.

Vanadium Ore—$1.25 per lb. of V_2O_5 (guaranteed minimum of 11 per cent V_2O_5), New York.

Zircon—Washed, iron free, 6c. per lb. **Zirkite**—$90@$100 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

Zinc and Lead Ore Markets

Joplin, Mo., July 31—Zinc blende, per ton, high, $50.90; basis 60 per cent zinc, premium, $48.50; Prime Western, $47.50; fines and slimes, $45@$42.50; calamine, 40 per cent zinc, $36. Average settling prices: Blende, $44.23; calamine, $36; all zinc ores, $44.03.

Lead, high, $103; basis 80 per cent lead, $100; average settling price, all grades of lead, $100 per ton.

Shipments for the week: Blende, 7,327; calamine, 172; lead, 1,108 tons. Value, all ores the week, $440,980.

Shipments for seven months: Blende, 340,589; calamine, 5,885; lead, 53,405 tons. Value, all ores seven months, $22,492,790.

Platteville, Wis., Aug. 1—Blende, basis 60 per cent zinc, $51@$53 base for high-grade blende. Lead ore, basis 80 per cent lead, $95 per ton.

Shipments for the week: Blende, 1,555; calamine, 60; lead, 35; sulphur ore, 44 tons. Shipments for the year: Blende, 41,778; calamine, 2,300; lead, 3,680; sulphur ore, 1,142 tons. Shipped during the week to separating plants, 2,545 tons blende. Owing to general unfavorable conditions mines continue to close. The Wisconsin Zinc Co. ceased producing operations this week.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $2,400@$3,000; No. 2, $1,400@$1,700; spinning fibres, $400@$800; magnesia and compressed sheet fibres, $325@$400; shingle stock, $110@$150; paper stock, $60@$75; cement stock, $17.50@$30; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as Canadian royalty export sales tax. Freight rate from mines to Sherbrooke, Quebec, over Quebec Central R.R., 20c. per cwt.; from Sherbrooke to New York, 27½c., carload lots; freight to New York for crude No. 1, f.o.b. Thetford mines, $8.45 per ton, carload lots.

Barytes — Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $22@$25 in bags, carload lots; (off-color) $18@$20 in bags, carload lots; all f.o.b. Kings Creek, S. C. Crude, 88 to 94 per cent, $12 per gross ton; ground (white) $23@$25; ground (off color) $16@$19 per net ton, f.o.b. Cartersville, Ga. Crude, 88 to 94 per cent, $23; ground (white) $40.50; ground (off color) $27 per net ton, less than carload lots, f.o.b. New York. Crude, not less than 98 per cent, $11@$11.25 per ton, f.o.b. cars, Missouri; floated, $28 per ton in bbls.; $26.50 per ton in 100-lb. bags; extra charge for bags, f.o.b. St. Louis.

Chalk—Domestic, extra light, 5@6c. per lb.; light, 4½@5½c.; heavy, 4@5c; English, extra light, 5@7c.; light, 5@6c.; dense, 4½@5c. per lb., all f.o.b. New York.

China Clay (Kaolin) — Crude, $9@$12; washed, $12@$15; powdered, $18@$22; bags extra, per net ton, f.o.b. mines, Georgia; crude, $8@$12; ground,

$15@$40, f.o.b. Virginia points. Domestic lump, $10@$20; powdered, $25@$30; imported lump, $25@$35; powdered, $30@$60, f.o.b. New York.

Feldspar—Crude, $7.50@$8 per gross ton, f.o.b. Maryland and North Carolina points; $7.50@$10, f.o.b. Maine; ground, $30, car lots, f.o.b. Baltimore; ground, $17@$20, f.o.b. North Carolina points; $17@$20 per ton, No. 1 ground, f.o.b. New York State; $21@$23 per ton, ground, f.o.b. Maine.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $25 per ton, f.o.b. Illinois mines, and $27.50, f.o.b. Kentucky; ground, suitable for acid, chemical or enameling purposes, $60; lump, $17.50, f.o.b. Tonuco, N. M.

Graphite—Crucible flake, 85 per cent carbon content, 8c. per lb.; 88 per cent, 9½c.; 90 per cent, 10½c., all f.o.b. New York. Crucible grades of Alabama graphite sell as follows, f.o.b. Ashland, Ala.: 80 per cent, 5c.; 90 per cent, 10c. Lubricating grades in increasing demand, with price ranging from 11c. for the 85 per cent guaranteed grade in car lots to 30 and 40c. for higher grades. Mexican, amorphous, $45@$55 per short ton; Korean, 3½c. per lb.; Madagascar, 8c.; Ceylon, 4½@15½c.

Gypsum—Raw crushed rock, $3.50@$4 per ton; raw ground fine, $4@$4.50; calcined stucco, $9, all f.o.b. works. Containers extra. Wholesale, plaster of paris, carload lots, $3.75 per 250-lb. bbl., alongside dock, New York.

Kaolin—See China Clay.

Limestone—Dolomite, 1@2 man size, $1.60@$1.65; 2@8 in., $1.55@$1.65 per net ton, f.o.b. Plymouth Meeting, Pa.; fluxing, $1.65@$1.75 per net ton, f.o.b. Howellville, Pa.

Magnesite, Calcined — High-grade caustic calcined, lump form, $35@$40 per ton, carload lots, f.o.b. California points. Freshly ground calcined, suitable for flooring trade, $65@$75 per ton, f.o.b. Eastern points.

Dead-Burned — $32.50 per net ton, Chewelah, Wash.; $52@$58, Chester, Pa. Austrian grade, $52@$55 per ton, f.o.b. Baltimore. (Magnesite brick—See Refractories.)

Mica—Imported block mica slightly stained, per lb.: No. 6, 50c.; No. 5, $1.20@$1.40; No. 4, $2@$3; No. 3, $4.25@$5; No. 2, $5.50@$7; No. 1, $8. Clear block: No. 6, 55c.; No. 5, $2; No. 4, $4; No. 3, $5.75; No. 2, $7; No. 1, $9; A1, $14; extra large, $25, all f.o.b. New York; ground, $85@$100 per ton, Philadelphia.

Monazite — Minimum of 6 per cent thorium oxide, $35 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $13; 75 per cent, $11.50; 75@74 per cent, $11; 70 per cent, $8.35; 68 per cent, $7.85; 68@66 per cent, $7.60. There is no price schedule for spot for domestic uses.

Pumice Stone—Imported, lump, 4@50c. per lb.; domestic lump, 6c.; ground, 4@7c., all f.o.b. New York.

Pyrites—Spanish, fines, per unit 12c., c.i.f. Atlantic seaport; furnace size, 16½c.; run of mine, 12@14c.; domestic, fines, f.o.b. mines, 12@14c.

Quartz—(Acid tower) fist to head, $10; 1¼ to 2 in., $14; rice, $17, all net ton, f.o.b. Baltimore; lump, carload lots, $5@$7.50 net ton, f.o.b. North Carolina mines. F.o.b. Wausau, Wis., the price is $16 per ton in car lots, and $20 in less quantities, including bags.

Sulphur—$18 per ton for domestic; $20 for export, f.o.b. Texas and Louisiana mines.

Talc — Paper making, $13@$20 per ton; roofing grades, $12@$15; rubber grades, $12@$45, all f.o.b. Vermont. California talc, $20@$35, talcum powder grade. Southern talc, powdered, car load lots, $15@$20 per ton; less than carload, $25, f.o.b. cars; freight to New York $5.25 per ton, carload lots; less than carload lots, $9.25. Imported, $60@$70; Canadian, $20@$40 per ton.

Mineral Products

Arsenic—White arsenic, 15½c. per lb.; sulphide, powdered, 20@21c. per lb., f.o.b. works, carload lots.

Nitrate—Soda, $3.85 per cwt., ex vessel, Atlantic ports. Market quiet.

Potassium Sulphate—Domestic, $2.25@$2.50 per net ton, basis 90 per cent, f.o.b. New York.

Ferro Alloys

Ferrocarbontitanium—For 15-18 per cent material, $200@$250 per ton, f.o.b. Niagara Falls, N. Y.

[1]**Ferrocerium**—Per lb., $12@$15. Foreign conditions as affecting the price of American goods remain unchanged.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 17@18c. per lb. of chromium contained; 4 to 6 per cent carbon, 19@20c. f.o.b. works.

Ferromanganese—For 76@80 per cent, prompt delivery, $225, freight allowed; last half, $200@$220; English, $200, c.i.f. Atlantic seaports. Spiegeleisen, 18@22 per cent, $75, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.50@$3 per lb. of contained metal, f.o.b. works.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $60@$65; 50 per cent, $80@$85; 75 per cent, $150@$160.

Ferrotungsten—70 to 80 per cent W, $1.10@$1.15 per lb. of contained tungsten, f.o.b. works.

Ferro-uranium—35-50 per cent U, $7 per lb. of U contained, f.o.b. works.

Ferrovanadium—Basis 30-40 per cent, $6.50@$8.25 per lb. of V contained, f.o.b. works.

Metal Products

Copper Sheets — Current New York price, $33.50 per ton; wire, quoted 31½c.

[1]Furnished by Foote Mineral Co., Philadelphia, Pa.

Lead Sheets—Full lead sheets, 12½c.; cut lead sheets, 12½c. in quantity, mill lots.

Nickel Silver—Unchanged at 39½c. per lb. for 18 per cent nickel.

Yellow Metal — Dimension sheets, 26¾c.; sheathing, 25¾c.; rods, ⅜ to 3 in., 23¾c.

Zinc Sheets—$12.50 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter; zinc plates, 12c. per lb.

Refractories

Bauxite Brick—56 per cent alumina, $145 per 1,000, f.o.b. Pittsburgh.

Chrome Brick—$90@$100 per net ton, carload lots, eastern shipping points.

Chrome Cement—45 to 50 per cent Cr_2O_3, $50 per net ton, and $55 in sacks, carload lots, eastern shipping points.

Clay Brick — First-quality fire clay, 9-in. shapes, $50@$55 per thousand, Pennsylvania, Ohio, and Kentucky works; second quality, $45@$50. First quality, St. Louis, $45; New Jersey, $75.

Magnesite Brick—$100@$110 per ton, eastern shipping points; 9-in. straights, $90@$100; 9-in. arches, wedges and keys, $95@$105; soaps and splits, $110@$120.

Silica Brick—9-in. per 1,000, $51@$55, Birmingham, Ala.; $55@$60, Mount Union, Pa.; $55, Chicago district.

Iron Trade Review

Pittsburgh, Aug. 3, 1920

Pig Iron—The market continues dull in point of tonnage, and those who buy are only those who are insistent upon early deliveries. A little foundry has sold at $46, establishing the market at $1 advance, while bessemer on limited sales has gone at $47, involving $1 advance. We now quote: Bessemer, $47, basic, $46; foundry, $46, f.o.b. Valley furnaces, freight to Pittsburgh being $1.40.

Steel—Some offerings of sheet bars have been made by middle interests at $68, the former minimum having been $70. We quote: Billets, $60@$65; sheet bars, $68@$75; rods, $70@$75.

Birmingham, Ala., Aug. 2

That there will be need for large quantities of iron ore in the South for a long time is evidenced by the pig-iron and steel markets, sales having been made on which delivery can hardly be finished for six months and longer. Inquiries are being received daily now by the pig-iron manufacturers as to iron for 1921 delivery, and a few sales have been made. Quotations are showing a little more firmness, sales having been made at $43 per ton, No. 2 foundry, 1.75 to 2.25 per cent silicon, and $42 has been the staple price for some time. Full production at blast furnaces can be looked for into the second quarter of next year at least.

Charcoal and Coke

Charcoal—Willow, 7c. per lb. in bbls.; hardwood, 4½c. per lb., in 250-lb. bbls.

Connellsville — Furnace, $17@$18; foundry, $18@$20.

The Southern Phosphate-Rock Market*

A Brief Statement of the Trade Activities in the World's Leading Phosphate-Producing Region—Possible Impending Fall Shortage

AFTER the usual heavy spring and winter business, the customary lull in the phosphate-rock market and apparent inability to sell this material took place in April, May, and June, with an accompanying speeding up of mining on the part of producers, an invariable occurrence as the better weather of summer advances, resulting in what might be considered a soft market. As a matter of fact, some concession in price below $10 for 70 per cent ground rock, down as low as $9 per ton for this grade of material, was made, but instead of the Florida producers making a rush for domestic business, the export business was so enormously speeded up that domestic consumers were unable to draw on the anticipated over-production of Florida, and about the middle of last month another heavy surge took place in the demand for phosphate rock, resulting in the price going up for 70 per cent ground rock to $11 and $11.50 per short ton.

Unfortunately the supply of cars furnished to the Tennessee field was considerably cut down by the retardation of shipments during the spring fertilizer season, and it seems almost impossible to get the flow of empties started back to the Tennessee producers, with the result that a possible rock famine again confronts the acidulators or fertilizer manufacturers for this fall and winter.

Review of the Industry for 1919

The phosphate-rock mining industry in the United States experienced a greater swinging of the pendulum toward high prices during 1919 than has ever before been attained in the history of the industry. This history has been a succession of such swings of the pendulum from very high to very low, but with the exception of 1914, in each case the high swing had been higher than before and the low swing had never gone so far back as before. The last high swing of the pendulum had culminated in 1907 with the panic of that fall and the selling price of 75 per cent rock took a sudden downward surge from $7 per ton to $3 or $3.50 per ton. Following the panic the swing was, as usual, slow and gradually toward another high point, until 75 per cent rock had reached a price at $4.75 per ton during July, 1914. The outbreak of the European war, by cutting off export shipments, caused the supply to be exactly double the immediate demand, as prior to 1914, about one-half of the total production of phosphate rock in the United States was shipped abroad. In this way, the phosphate rock business was affected as adversely by the war as it favorably affected other lines of chemical and metallurgical industry.

Growing Domestic Consumption

The following table shows for selected years from 1874 to 1918 the total sales of phosphate rock in each of the years named, the amount exported and the amount sold for domestic consumption.

SALES OF PHOSPHATE ROCK IN THE U. S. IN TONS OF 2,240 LBS

Year	Total	Exported	Domestic Sales
1874	122,790	70,546	52,244
1887	480,588	199,735	280,853
1907	2,251,459	1,018,212	1,233,247
1913	3,111,221	1,366,508	1,744,713
1914	2,734,043	964,114	1,769,929
1915	1,835,667	253,421	1,582,246
1916	1,982,385	243,678	1,738,707
1917	2,584,287	166,358	2,417,829
1918	2,490,760	143,455	2,347,305

The year 1874 is selected as the first year for which complete statistics of both export and domestic shipments are available, 1887 as the high point of the period of recovery following the disturbed conditions of the 70's, and 1907 as the high point of the period terminated by the panic of that year. The year 1913 has been selected as the peak of the last full calendar year before the European war, and 1914 to 1918 inclusive are given to show the course while the European war was in progress.

Business in 1919 had been well on its way to a large increase over 1918, when the Florida strike, culminating in April, resulted in such a heavy decrease in shipments from that field from April to October or November as to bring the 1919 estimate of consumption slightly lower than 1918, notwithstanding the herculean efforts made by Tennessee producers to make up the deficit in the Florida output. The present activity and demand are somewhat of a reaction to the disturbing labor troubles of last year.

Changes in the Uses of Phosphate

The ordinary consumption of phosphate rock in the past has been practically entirely confined to the manufactures of acid phosphate for fertilizers, but in the last few years the development of phosphate baking powders, and increased amount of phosphorus and phosphorous compounds manufactured from phosphate rock have constituted a considerable factor in the demand. Added to this, the use of the low-grade soft phosphates of Florida and the high-grade soft brown phosphates of Tennessee for direct application to the soil without acidulation has greatly increased, and bids fair in a short time to outstrip acid phosphate as a chief application of phosphate rock.

Practically all of the phosphate plants in Tennessee have increased their productive capacity and several entirely new developments have been made which are just coming on the market.

If the Florida producers pursue the same tactics that they have in the past, of competing with their very large production against the comparatively small production possible from Tennessee, lower prices may be secured by the fertilizer manufacturers in new low-priced long-time contracts.

The steady course of the phosphate-rock market seems to be toward a price per unit of phosphorus equal to that paid for bones used in the manufacture of phosphorus.

Were the Tennessee fields to attempt production of any such large tonnage as Florida produces, the high-grade brown rock would be quickly exhausted; hence there should be no difficulty whatever in any owner of this material ultimately securing from $10 to $15 per ton for all he has left.

The tendency of many of the largest holders of phosphate-rock deposits, because they are primarily fertilizer manufacturers, has been to keep down the price of phosphate rock and thus show a greater profit in the manufacture of fertilizer, and it is a question whether the results brought about by this tendency have been in any way healthy for the industry. The fertilizer industry in general may find it advantageous to consider the basic raw material of their business on the same plane as sulphuric acid and other materials entering into the manufacture of the complete fertilizer, instead of, as in the past, keeping phosphate in a condition prejudiced to their general welfare.

During recent periods of depression, some large phosphate producers again made low-price long-time contracts covering future requirements. It is the opinion of an important producer in close touch with the market that those who have done so will be as regretful as they were during the last two or three years of advancing prices, with the old $4, $5 and $6 contracts in force. If the holders of phosphate-rock deposits will join in a wise policy of conservation of this most important basic commodity, it will be easily possible to maintain the market on the steady progressive plan which will redound to the greatest good of the general public interested in the transmutation of this important element into food.

H. D. RUHM.

*See editorial comment on phosphate rock in the United States on page 245.

Correction—In the issue of July 31, the balance of the Howe Sound Co. should have read $3,220,381.39, instead of $441,738.72.

METAL STATISTICS

Monthly Average Prices of Metals

Silver

	New York			London		
	1918	1919	1920	1918	1919	1920
January	88.702	101.125	132.827	44.356	48.438	79.846
February	85.716	101.125	131.295	42.792	48.027	85.005
March	88.082	101.125	125.551	43.620	48.171	74.194
April	95.346	101.125	119.779	47.215	48.886	68.848
May	99.505	107.135	102.585	48.980	52.104	60.010
June	99.500	110.430	90.957	48.875	53.896	51.096
July	99.625	106.394	91.971	48.813	54.133	53.736
August	100.292	111.370	.....	49.077	58.835	.....
September	101.125	114.540	.....	49.500	61.668	.....
October	101.125	119.192	.....	49.500	64.049	.....
November	101.125	127.924	.....	48.969	70.065	.....
December	101.125	131.976	.....	48.492	76.432	.....
Year	96.772	111.122	.....	41.516	57.059	.....

New York quotations cents per ounce troy, .999 fine. London, pence per ounce, sterling silver, 925 fine.

Copper

	New York		London			
	Electrolytic		Standard		(*b*) Electrolytic	
	1919	1920	1919	1920	1919	1920
January	(*a*)	18.918	92.238	118.095	106.619	123.238
February	16.763	18.569	78.700	120.188	95.700	126.950
March	14.856	18.331	76.821	109.533	82.071	118.348
April	15.246	18.660	77.300	103.025	82.200	111.500
May	15.864	18.484	77.767	96.750	81.227	109.200
June	17.610	18.065	83.062	87.864	85.900	101.909
July	21.604	18.576	99.576	90.148	103.046	106.455
August	22.319	.....	97.300	.....	106.429	.....
September	21.755	.....	100.767	.....	.....	.....
October	21.534	.....	103.418	.....	.....	.....
November	19.758	.....	98.894	.....	.....	.....
December	18.295	.....	103.708	.....	.....	.....
Year	18.691	.....	90.796	.....	.....	.....

(*a*) No market. (*b*) See note on page 287.

Lead

	New York		St. Louis		London	
	1919	1920	1919	1920	1919	1920
January	5.432	8.561	5.316	8.300	37.227	47.095
February	5.057	8.814	4.784	8.601	28.675	50.256
March	5.226	9.145	4.992	8.894	27.952	46.054
April	4.982	8.902	4.722	8.618	24.888	39.225
May	5.018	8.576	4.773	8.352	23.852	38.488
June	5.340	8.323	5.070	8.169	22.544	34.330
July	5.626	8.338	5.408	8.283	23.457	34.960
August	5.798	.....	5.583	.....	25.330	.....
September	6.108	.....	5.853	.....	28.473	.....
October	6.487	.....	6.249	.....	34.731	.....
November	6.808	.....	6.649	.....	41.202	.....
December	7.231	.....	6.955	.....	.....	.....
Year	5.759	.....	5.530	.....	28.590	.....

Tin

	New York				London	
	1919		1920			
	99%	Straits	99%	Straits	1919	1920
January	67.702	.....	61.596	.....	248.557	376.512
February	66.801	.....	58.466	59.932	223.963	395.750
March	67.934	.....	61.037	61.926	236.843	369.489
April	72.500	.....	61.120	62.115	225.275	345.450
May	72.500	.....	53.230	55.100	234.398	294.813
June	71.240	.....	46.125	48.327	238.263	250.614
July	68.000	.....	45.798	49.154	253.272	261.886
August	57.226	.....	.....	.....	273.625	.....
September	54.482	.....	.....	.....	280.102	.....
October	54.377	.....	.....	.....	279.239	.....
November	53.307	.....	.....	.....	283.556	.....
December	53.870	.....	.....	.....	314.113	.....
Av. year	63.328	.....	.....	.....	257.601	.....

Zinc

	New York		St. Louis		London	
	1919	1920	1919	1920	1919	1920
January	7.272	9.483	6.922	9.133	56.045	58.643
February	6.623	9.058	6.273	8.708	46.150	61.338
March	6.500	8.881	6.150	8.531	38.500	53.467
April	6.465	8.534	6.114	8.184	36.118	47.388
May	6.429	7.938	6.079	7.588	35.477	45.088
June	6.901	7.815	6.551	7.465	36.763	41.193
July	7.873	8.070	7.523	7.720	41.815	41.886
August	7.789	.....	7.160	.....	39.338	.....
September	7.510	.....	7.473	.....	40.955	.....
October	7.823	.....	7.827	.....	43.630	.....
November	8.177	.....	8.350	.....	46.588	.....
December	8.700	.....	8.350	.....	53.101	.....
Year	7.338	.....	6.988	.....	42.879	.....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Pig Iron, Pittsburgh

	Bessemer ‡		Basic ‡		No. 2 Foundry	
	1919	1920	1919	1920	1919	1920
January	$33.60	$40.47	$31.40	$39.88	$32.40	$39.86
February	33.60	42.954	31.40	42.61	32.40	43.40
March	32.54	43.40	31.40	42.90	29.12	43.40
April	29.35	43.72	27.15	44.22	28.15	43.90
May	29.35	44.003	27.15	44.885	28.15	45.36
June	29.35	44.89	27.15	45.41	28.15	46.40
July	29.35	47.21	27.15	47.42	28.15	46.56
August	29.35	.....	27.15	.....	28.15	.....
September	29.35	.....	27.15	.....	28.15	.....
October	29.35	.....	27.15	.....	28.30	.....
November	31.60	.....	31.56	.....	32.16	.....
December	36.57	.....	35.32	.....	36.86	.....
Year	$31.11	.....	$29.26	.....	$28.35	.....

‡ As reported by W. P. Snyder & Co.

Antimony, New York; July, 7.500c.

Quicksilver, New York; July, $90.333.

Monthly Copper Production

The table which appears herewith represents the crude-copper content of blister copper, in pounds.

MONTHLY CRUDE COPPER PRODUCTION, 1920

	March	April	May	June
Alaska shipments	4,897,088	6,507,515	7,331,59	7,213,820
Arizona:				
Arizona Copper	3,000,000	3,000,000	3,000,000	3,000,000
Calumet & Arizona	4,428,000	3,176,000	4,760,000	4,764,000
Cons. Ariz. Smelting	1,250,000	1,200,000	1,250,000	940,000
Inspiration	6,5 0,000	6,000,000	7,500,000	7,300,000
Magma	830,735	895 082	918,321	755,601
Miami	4,091,535	4,924,420	5,054,760	4,400,000
New Cornelia	3,408,000	3,560,000	3,720,000	3,664,000
Old Dominion	2,358,000	2,180,000	2,287,400	2,999,000
Phelps Dodge	6,145,000	5,700,000	6,761,000	6,627,000
Shattuck Arizona	344,938	214,122	219,118	198,327
Ray	3,900,000	4,500,000	4,260,000	4,520,000
United Verde	5,900,000	5,300,000	5,400,000	5,880,000
United Verde Extension	3,977,898	3,270,718	3,219,934	2,828,020
Michigan:				
Calumet & Hecla	9,880.577	9,532,476	8,803,811	9,022,879
Other Lake Superior	6,420,000	6,420,000	6,200,000	6,200,000
Montana:				
Anaconda	18.450,000	15,800,000	9,700,000	12,700,000
East Butte	1,909,720	1,291,840	1,412,760	1,396,140
Nevada:				
Nevada Cons	3,700,000	4,140,000	4,350,000	4,650,000
New Mexico:				
Chino	4,413,329	3,543,471	3,930,728	4,010,069
Utah:				
Utah Copper	8,894,596	9,313,227	9,904,781	10,000,000
Eastern Smelters	1,610,000	1,610,000	1,600,000	1,600,000
Total reported	106,308,916	102,078,871	101,584,207	104,668,856
Others, estimated	14,000,000	14,000,000	13,380,000	12,000,000
Total United States	120,308,916	116,078,871	114,964,207	116,668,856
Imports: Ore and concentrates, etc	9,766,336	7,766,457	1,607,003	.....
Imports in blister, etc	19,108,437	14,182,933	43,253,540	.....
Grand total	149,183,689	138,028,261	168,824,750	.....
British Columbia:				
Granby Cons	2,095,500	2,105,400	2,131,219	2,079,000
Mexico:				
Boleo	1,193,416	1,063,168	650,908	802,474
Cananea	3,700,000	4,000,000	4,300,000	3,750,000
Phelps Dodge Mexican properties	1,786,000	2,098,000	1,141,000	1,427,000
Other foreign:				
Cerro de Pasco	5,658,000	3,942,000	3,890,000	3,944,000
Chile	9,256,000	8,172,000	10,300 000	7,500,000
Katanga	3,229,739	2,601.428	3,847,027	4,323,221
Backus & Johnston	958,000	1,354,000	.....	1,382,000

Domestic copper production for 1918, 1919, and part of 1920 follows:

	1918	1919	1920
January	165,431,568	135,733,511	121,903,744
February	160,011,364	111,649,512	117,450,000
March	185,525,168	102,040,460	120,309,316
April	163,207,096	98,808,998	116,078,871
May	181,070,350	92,652,975	114,964,207
June	166,723,599	95,856,570	116,668,856
July	159,329,031	100,369,247	.....
August	165,550,799	107,994,040	.....
September	157,992,487	108,703,075	.....
October	168,638,775	115,143,143	.....
November	159,217,588	117,289,735	.....
December	161,801,916	102,997,633	.....

MINING STOCKS

Week Ended July 31, 1920

Stock	Exch.	High	Low	Last	Last Div.	
COPPER						
Adventure	Boston			*65		
Ahmeek	Boston	59½	58	58	June '20, Q	.50
Alaska-B.C.	N. Y. Curb	1 1/16	½	½		
Allouez	Boston	26¾	25	2[illegible]	Mar. '19,	1.00
Anaconda	N. Y.	55¼	52⅞	53½	Feb. '20, Q	1.00
Ariz. Com'l	Boston	10¼	9¼	10¼	Oct. '18,	.50
Big Ledge	N. Y. Curb	3/16	1/16	⅛		
Bingham Mines	Boston	8⅜	8⅛	8⅛	Sept. '19, Q	.25
Calumet & Ariz.	Boston	58½	56½	57	June '20, Q	1.00
Calumet & Hecla	Boston	300	299	300	June '20, Q	5.00
Canada Copper	N. Y. Curb	1/16	⅛	1/16		
Centennial	Boston			11¼	Dec. '18, SA	1.00
Cerro de Pasco	N. Y.	44	41½	42	June '20, Q	1.00
Chief Consol	Boston Curb	3⅜	3⅛	3⅛	Feb. '20, Q	.10
Chile Cop	N. Y.	15	14	14⅜		
Chino	N. Y.	29¼	27⅜	29⅛	June '20, Q	.37½
Columbus Rexall	Salt Lake	*41½	*35	*36½		
Con. Ariz	N. Y. Curb			1/16	Dec. '18, Q	.05
Con. Copper M	N. Y. Curb			2⅛		
Copper Range	Boston	38½	37	37½	June '20, Q	.50
Crystal Copper	Boston Curb	*30	*26	*27		
Davis-Daly	Boston	8¾	8½	8½	Mar. '20, Q	.25
East Butte	Boston	12	11½	11½	Dec. '19, A	.50
First Nat'l	Boston Curb	*95	*90	*92	Feb. '19, SA	.15
Franklin	Boston	*90	*70	*80		
Gadsden Copper	N. Y. Curb			*71		
Granby Consol	N. Y.	36	36	36	May '19, Q	1.25
Greene-Can	N. Y.	29½	28	28	Feb. '19, Q	1.50
Hancock	Boston			4½		
Houghton	Boston Curb			*60		
Howe Sound	N. Y. Curb	3¾	3½	3¾	July '20, Q	.05
Inspiration Con	N. Y.	50	47⅝	49½	July '20, Q	1.00
Iron Cap	Boston Curb	8¾	8½	8¾	Feb. '19, M	.25
Isle Royale	Boston	29	29	29	Sept. '19, SA	.50
Kennecott	N. Y.	25¾	23⅞	24⅜	June '20, Q	.50
Keweenaw	Boston			1⅜		
Lake Copper	Boston	3	3	3		
La Salle	Boston			3		
Magma Chief	N. Y. Curb			*21		
Magma Copper	N. Y. Curb			30	Jan. '19, Q	.50
Majestic	Boston Curb			*15		
Mason Valley	N. Y. Curb			2⅜		
Mass. Con	Boston	3½	3	3	Nov. '17, Q	1.00
Mayflower-O.C.	Boston	5½	4⅜	5		
Miami	N. Y.	20½	19¾	20	May '20, Q	.50
Michigan	Boston	4¼	4	4		
Mohawk	Boston	61	60½	60½	Feb. '20, Q	1.50
Mother Lode (new)	N. Y. Curb	6	5¾	5⅞		
Nevada Con	N. Y.	12⅛	11⅜	11⅝	June '20, Q	.25
New Arcadian	Boston	3	3	3		
New Baltic	Boston Curb			3		
New Cornelia	Boston	17½	17	17½	May '20,	.25
Nixon Nev	N. Y. Curb			*9		
North Butte	Boston	16½	15½	15⅝	Oct. '18, Q	.25
North Lake	Boston			*60		
Ohio Copper	N. Y. Curb			1/16		
Oilbway	Boston			1⅛		
Old Dominion	Boston	24½	24	24	Dec. '18, Q	1.00
Osceola	Boston	39	37½	37½	June '20, Q	.50
Phelps Dodge	Open Mar.	†195	†180	...	July '20, Q	2.50
Quincy	Boston	49	48	49	Mar. '20, Q	1.00
Ray Con	N. Y.	16	15⅜	15⅜	June '20, Q	.25
Ray Hercules	Boston Curb			*60		
St. Mary's M. L.	Boston	39	39	39	June '20, K	2.00
Seneca	Boston	14	13½	13½		
Shannon	Boston	1⅜	1⅛	1⅜	Nov. '17, Q	.25
Shattuck Ariz	N. Y.	9	8¼	8¾	Jan. '20, I	.25
South Lake	Boston	2	2	2		
South Utah	Boston			*15		
Superior	Boston			5	Apr. '17,	1.00
Superior & Boston	Boston	3½	3	3½		
Tenn. C. & C.	N. Y.	10	9	9¼	May '18, I	1.00
Tuolumne	Boston	*55	*55	*55	May '13,	.10
United Verde Ex.	Boston Curb	31½	30½	30⅞	June '20, Q	1.50
Utah Con	Boston	6	6	6	Sept. '18,	.25
Utah Copper	N. Y.	66½	64⅜	65	June '20, Q	1.50
Utah M. & T.	Boston	1½	1¼	1⅜	Dec. '17,	.30
Victoria	Boston	2	2	2		
Winona	Boston	*59	*50	*50		
Wolverine	Boston	15	15	15	Jan. '20, Q	.50
LEAD						
Hecla	N. Y. Curb	4⅛	3 11/16	4	June '20, QX	.20
St. Joseph Lead	N. Y.	15½	15¼	15¼	June '20, QX	.50
Stewart	Boston Curb			*16	Dec. '15,	.05
Utah Apex	Boston	1⅜	1⅛	1⅜	Nov. '18,	.25
ZINC						
Am. Z. L. & S.	N. Y.	13⅜	12⅛	13	May '17,	1.00
Am. Z. L. & S. pf	N. Y.	44¾	44¼	44¾	May '20, Q	1.50
Butte C. & Z.	N. Y.	8⅛	7⅛	7⅛	July, 18, I	.50
Butte & Superior	N. Y.	22⅜	20	20	Sept. '17,	1.25
Con. Interst. Cal.	N. Y.	11⅛	10⅜	11	June '20, Q	.50
New Jersey Z.	N. Y. Curb	196	186	188	May '20, SA	4.00
Success	N. Y. Curb	*4¾	*4	*4½	July '16,	.03
Yellow Pine	Los Angeles			1.01	June '20, Q	.03

Stock	Exch.	High	Low	Last	Last Div.	
GOLD						
Alaska Gold	N. Y.	1⅜	1¼	1¼		
Alaska Juneau	N. Y.	1⅞	1⅝	1⅝		
Carson Hill	N. Y. Curb			26½		
Cresson Consol. G.	N. Y. Curb			1⅞	June '20, Q	.10
Dome Ex.	Toronto	*25	*24	*24½		
Dome Mines	N. Y.	10⅜	10	10	July '20, Q	.25
Golden Cycle	Colo. Sprgs.	‡		*73	May '20, Q	.02
Goldfield Con.	N. Y. Curb	*10	*8	*10	Dec. '19,	.05
Hedley	Boston			4½	June '19,	.10
Hollinger Con.	Toronto	5.60	5.48	5.48	June '20, BM	.05
Homestake	N. Y.			55	Sept. '19,	.50
Kirkland Lake	Toronto	*54	*50	*54		
Lake Shore	Toronto	1.25	1.17	1.17	Oct. '19,	.02½
McIntyre-Porcupine	Toronto	1.95	1.89	1.89	May '20, K	.05
Porcupine Crown	Toronto	*27	*26	*26	July '17,	.03
Portland	Colo. Sprgs.	‡		*60	July '20, Q	.01½
Reorgan. Booth	N. Y. Curb	*4½	*3	*4	May '19,	.05
Silver Pick	N. Y. Curb	*6	*4½	*6		
Teck Hughes	Toronto	*9	*8	*8		
Tom Reed	Los Angeles	1.03	1.00	1.03	Dec. '19,	.02
United Eastern	N. Y. Curb	2 1/16	2⅛	2 1/16	Apr. '20, Q	.21
Vindicator Consol.	Colo. Sprgs.	‡		*18	Jan. '20, Q	.01
West Dome	Toronto	*7	*7	*7		
White Caps Min.	N. Y. Curb	*10	*8½	*9		
Yukon Gold	Boston Curb			1	June '18,	.02½
SILVER						
Arizona Silver	Boston Curb	*20	*14	*17	Apr. '20, M	.03
Beaver Con.	Toronto	*44½	*43	*44	May '20, K	.03
Coniagas	Toronto	†3.50	†2.50		May '20, Q	.25
Crown Reserve	Toronto	*25	*25	*25	Jan. '17,	.05
Kerr Lake	Boston	3⅜	3¼	3¼	Sept. '19,	1.00
La Rose	Toronto	*35	*32	*32	Apr. '18,	.02
McKinley-Dar.	N. Y. Curb			*50	July '20, Q	.03
Mining Corp.	Toronto	1.85	1.84	1.84	June '20, Q	.12½
Nipissing	N. Y. Curb	8⅜	8⅛	8⅛	July '20, Q	.25
Ontario Silver	N. Y.	6	5⅛	5⅛	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	⅜	¼	⅜	Jan. '12,	.10
Peterson Lake	Toronto	*13¼	*12¼	*12½	Jan. '17,	.01½
Sil. King Ariz.	N. Y. Curb			*34		
Temiskaming	Toronto	*34½	*34	*34	Jan. '20, K	.04
Trethewey	Toronto	*29¼	*28	*28¼	Jan. '19,	.05
GOLD AND SILVER						
Atlanta	N. Y. Curb	*2	*1½	*1½		
Barnes-King	Butte			1.11	May. '20, Q	.05
Bost. & Mont.	Boston			*63		
Cashboy	N. Y. Curb	*7½	*7	*7		
El Salvador	N. Y. Curb	2⅛	1⅜	1⅜		
Jim Butler	N. Y. Curb	*14	*12	*12½	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*5	*4	*5	June '16,	.05
Louisiana Con	N. Y. Curb			1/16		
MacNamara M.	N. Y. Curb	¼	3/16	½	May '10,	02½
N.Y. Hond. Rosar	Open Mar.	†13	†11½		July '20, QX	.50
Tonopah-Belmont	N. Y. Curb	1⅜	1⅛	1 1/16	Jan. '20, Q	.05
Tonopah-Divide	N. Y. Curb	1 1/16	1⅛	1⅛		
Tonopah Ex.	N. Y. Curb	1⅜	1	1 1/16	July '20, Q	.05
Tonopah Mining	N. Y. Curb	1⅜	1⅛	1⅜	Oct. '19, SA	.15
West End Con.	N. Y. Curb	1 1/16	1 1/16	1 1/16	Dec. '19 SA	.05
SILVER-LEAD						
Caledonia	N. Y. Curb	*23	*18	*19	July, '20, M	.01
Consol. M. & S.	Montreal	26	25	25½	July '20, Q	.62½
Daly Mining	Salt Lake			2.60	July '20, Q	.10
Daly-West	Boston			4	July '20, Q	.25
Eagle & Blue Bell	Boston Curb			2 1/16	Apr. '20, Q	.10
Electric Point	Spokane			30	May '20, SA	.03
Fed. M. & S.	N. Y.	12	12	12	Jan. '09,	1.50
Fed. M. & S. pf.	N. Y.	34½	33½	34½	June, '20, Q	1.75
Florence Silver	Spokane			*45	Apr. '19,	.01½
Iron Blossom	N. Y. Curb	1/16	1/16	1/16	Apr. '20, Q	02½
Judge M. & S.	Salt Lake			3.90	July '20, Q	12½
Marsh Mines	N. Y. Curb	*12	*10	*11		
Prince Consol.	N. Y. Curb	1/16	⅛	1/16	Nov. '17,	.02½
Rambler-Cariboo	Spokane			*10	Feb. '19,	.01
Rex Con.	N. Y. Curb	*7	*6	*7		
South Hecla	Salt Lake			*96	Sept. '19, K	0.15
Stand. S. L.	N. Y. Curb	¼	¼	¼	Oct. '17,	.05
Tamarack-Custer	Spokane			2.42	Dec. '19, K	.03
Tintic Standard	Salt Lake	3.40	3.35	3.40	June '20, Q	0.10
Wilbert	N. Y. Curb	*4½	*3½	*3½	Nov. '17,	.01
NICKEL-COPPER						
Internat'l Nickel	N. Y.	18⅛	17⅛	17½	Mar. '19,	.50
Internat'l Nick.pf	N. Y.			81	May '20, Q	1.50
QUICKSILVER						
New Idria	Boston			5	Jan. '19,	.25
TUNGSTEN						
Mojave Tungsten	Boston Curb			*10		
VANADIUM						
Vanadium Corp.	N. Y.	83½	74	75½	July '20, Q	1.50
ASBESTOS						
Asbestos Corp.	Montreal	87½	82	84	July '20, Q	1.50
Asbestos Corp. pf.	Montreal	95½	93½	94½	July '20, Q	1.75
MINING, SMELTING AND REFINING						
Am. S. & R.	N. Y.	58⅜	55⅛	56½	June '20, Q	1.00
Am. S. & R.pf.	N. Y.	90⅜	88⅛	88⅛	June '20, Q	1.75
Am. Sm. pf.A	N. Y.			75	July '20, Q	1.50
U. S. Sm. R. & M.	N. Y.	57	55	55	July '20, Q	1.50
U.S.S.R.& M. pf.	Boston	44½	43	44	July '20, Q	.87½

*Cents per share. †Bid or asked. ‡Quotations missing. Q, Quarterly.
SA, Semi-annually. BM, bimonthly. K, Irregular. I, Initial. X, includes extra